BIOLOGICAL OPINION

For

Coastal Plain Oil and Gas Leasing Program
Arctic National Wildlife Refuge

Consultation with the
Bureau of Land Management

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LIST OF ABBREVIATIONS USED IN THIS DOCUMENT

ABR	Alaska Biological Research, Inc.
ACP	Arctic Coastal Plain
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AO	Authorized Official
AOGCC	Alaska Oil and Gas Conservation Commission
BA	Biological Assessment
BMP	Best Management Practice
BLM	Bureau of Land Management
BO	Biological Opinion
BOEM	Bureau of Ocean Energy Management
CI	Confidence Interval
CPF	Central Processing Facility
CRD	Colville River Delta
CS	Chukchi Sea Subpopulation of Polar Bears
DEIS	Draft Environmental Impact Statement
DMA	Division of Management Authority
DOI	Department of Interior
DPS	Distinct Population Segment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FR	Federal Register
GIS	Geographic Information System
IPCC	Intergovernmental Panel on Climate Change
ITRs	Incidental Take Regulations
ITS	Incidental Take Statement
IUCN	International Union for Conservation of Nature and Natural Resources
LBCHU	Ledyard Bay Critical Habitat Unit
LOA	Letter of Authorization
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MTR	Marine Transit Route
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPR-A	National Petroleum Reserve Alaska
NSE	North Slope Eider Survey
NSIDC	National Snow and Ice Data Center
NSO	No Surface Occupancy
OC	Organochlorine Compound
OSR	Oil Spill Response Plan
PBCMP	Polar Bear Conservation Management Plan
PBF	Physical or Biological Features
PBSG	Polar Bear Specialist Group

PCB	Polychlorinated Biphenyls
PCE	Primary Constituent Element
PCH	Porcupine Caribou Herd
PDC	Project Design Criteria
POP	Persistent Organic Pollutant
RFD	Reasonably Foreseeable Development
ROD	Record of Decision
ROP	Required Operating Procedure
RPM	Reasonable and Prudent Measure
SBS	Southern Beaufort Sea Subpopulation of Polar Bears
SE	Standard Error
SD	Standard Deviation
SPCCP	Spill Prevention, Control, and Countermeasure Plans
STP	Seawater Treatment Plant
TAPS	Trans-Alaska Pipeline System
TL	Timing Limitations
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
VSM	Vertical Support Member

1. INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service's or USFWS') biological opinion (BO) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.), on the effects of the Bureau of Land Management's (BLM's) proposed oil and gas leasing program on the Arctic Coastal Plain of the Arctic National Wildlife Refuge (hereafter, Coastal Plain of Arctic Refuge). This BO evaluates the potential effects of oil and gas leasing, development, production, and transportation in and from this area on species under the Service's jurisdiction that are listed as threatened or endangered, and designated critical habitat pursuant to the ESA.

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitats on which they depend. Section 7(a)(2) of the ESA states that Federal agencies must ensure that their activities are not likely to:

- Jeopardize the continued existence of any listed species, or
- Result in the destruction or adverse modification of designated critical habitat.

Federal agencies fulfill this obligation by consulting with the Service or National Marine Fisheries Service (NMFS), depending on the species potentially affected (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and the consulting agency (the Service or NMFS, as appropriate) concurs, consultation concludes informally (50 C.F.R. §402.14(b)). In the event of a determination that one or more listed species or designated critical habitat are "likely to be adversely affected" by the action, formal consultation is conducted. In this case, the BLM determined (BLM 2019) that one or more listed species would likely be adversely affected by the proposed oil and gas leasing program (Program), so formal consultation was conducted.

Section 7(b)(3) of the ESA requires that at the conclusion of formal consultation, the consulting agency provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If the action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat, the consulting agency provides reasonable and prudent alternatives that can be taken by the Federal agency or the applicant that allow the action to proceed in compliance with section 7(a)(2) of the ESA.

This BO, related to the effects of the BLM's proposed oil and gas leasing program on the Coastal Plain of Arctic refuge, was developed in accordance with section 7(a)(2) of the ESA (16 U.S.C. 1536 (a)(2)), associated implementing regulations (50 C.F.R. §§401-17), and Service policies and guidance. Updates to the regulations governing interagency consultation (50 CFR part 402) became effective on October 28, 2019 [84 FR 44976]. As the preamble to the final rule adopting the new regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice."

Thus, even though the Service primarily developed this BO while the prior regulations were in effect, none of the revisions effected by the new regulations necessitated any modifications to the scope, analysis, or determinations of this BO, which complies with both sets of regulations. The consultation addresses potential effects of the Program on threatened spectacled eiders (*Somateria fischeri*), Alaska-breeding Steller's eiders (*Polysticta stelleri*), polar bears (*Ursus maritimus*), and northern sea otters (*Enhydra lutris kenyoni*), and areas designated as critical habitat for these four species, as appropriate.

Programmatic Consultations

The Service and the NMFS have developed techniques to streamline the procedures and time involved in consultations for broad agency programs or numerous similar activities with predictable effects on listed species and critical habitat. Some of the more common of these techniques and the requirements for ensuring that streamlined consultation procedures comply with section 7 of the ESA and its implementing regulations are discussed in a memorandum jointly issued by the NMFS and the Service on October 11, 2002 (see also, 68 FR 1628-01 [January 13, 2003] for the notice of availability of the memorandum).

Programmatic consultations can be used to evaluate potential effects of 1) multiple similar, frequently occurring or routine actions expected to be implemented in particular geographic areas, 2) a proposed program, plan, policy, or regulation providing a framework for future actions, and 3) incremental step actions expected to be implemented in the future, where specifics of individual activities are not definitively known at the time of the initial consultation. The programmatic approach is well suited for the proposed Program because the Program is projected to last decades, it may include several stages (exploration, development, production, and abandonment) that will differ in their impacts and for which the likelihood, location, and specifics are currently uncertain, and precisely evaluating impacts is complicated by possible future changes in the abundance, distribution and status of listed species (particularly polar bears).

A programmatic consultation should identify project design criteria (PDCs) or standards that will be applicable to future projects implemented under the program. The PDCs serve to prevent adverse effects to listed species, or to limit adverse effects to predictable levels to ensure the action will not jeopardize the continued existence of listed species or destroy or adversely modify critical habitat, whether actions are considered individually or collectively at the program level. Under a programmatic consultation, step-down consultations are needed for actions that cannot be specifically described at the time of initial consultation and for those that cannot meet the PDCs.

The following elements should be included in a programmatic consultation to ensure its consistency with ESA section 7, and its implementing regulations:

1. PDCs to prevent or limit future adverse effects on listed species and designated critical habitat;
2. Description of the manner in which activities to be implemented under the programmatic consultation may adversely affect listed species and critical habitat and evaluation of expected level of adverse effects from covered projects;

3. Process for evaluating and tracking expected and actual aggregate (net) additive effects of all projects expected to be implemented under the programmatic consultation. The programmatic consultation document must demonstrate that when the PDCs are applied to each project, the aggregate effect of all projects would not jeopardize listed species or destroy or adversely modify critical habitat;
4. Procedures for streamlined step-down consultation. As discussed above, if an approved programmatic consultation document is sufficiently detailed, step-down consultations ideally will consist of certifications and concurrences between action agency biologists and consulting agency biologists. An action agency biologist or team will provide a description of a proposed project and a certification that it will be implemented in accordance with the PDCs. The action agency also provides a description of anticipated project-specific effects and a tallying of net effects to date resulting from projects implemented under the program, and certification that these effects are consistent with those anticipated in the programmatic consultation. The consultation agency biologist reviews the submission and provides concurrence, or adjustments to the project necessary to bring it into compliance with the programmatic consultation. The project-specific consultation process must also identify any effects not considered in the programmatic consultation. Finally, project-specific consultation procedures must provide contingencies for proposed projects that cannot be implemented in accordance with the PDCs; full stand-alone consultation may be performed on these projects if they are too dissimilar in nature or in expected effects from those projected in the programmatic consultation document;
5. Procedures for monitoring projects and validating effects predictions; and,
6. Comprehensive review of the program, generally conducted annually.

In a tiered approach, this programmatic consultation establishes a framework of analysis and standards that allow future step-down consultations (as needed) at the stage of implementing or authorizing individual activities to be more effective and efficient. The Services promulgated changes to the section 7(a)(2) implementing regulations (80 FR 26832, May 11, 2015; ITS rule) that define two types of programmatic actions addressing certain types of policies, plans, regulations, and programs. Under a framework programmatic action such as the Proposed Program evaluated here, take of ESA-listed species would not occur unless and until those future actions are authorized, funded, or carried out and subject to step-down consultation, which may include an incidental take statement (ITS), as appropriate. This is in contrast to a mixed programmatic action and consultation, which combines approval of actions that will not be subject to further ESA section 7(a)(2) consultation and approval of a framework for the development of future actions that are authorized, funded, or carried out at a later time.

2. ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with the Service, to ensure their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

“Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 C.F.R. §402.02).

“Destruction or Adverse Modification” means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of an ESA-listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 C.F.R. §402.02).

This assessment involves the following steps:

Description of the Proposed Action: We describe the Reasonably Foreseeable Development Scenario (RFD), including those activities expected to be implemented in the future for which step-down consultations will be required because the specifics are not known at this time. This section also includes the PDCs for avoidance and minimization of impacts to ESA-listed species and designated critical habitat, and information regarding the procedures for submitting step-down consultation requests and conducting regular reviews under the programmatic consultation.

Action Area: We describe the proposed action and those aspects of the proposed action that may have direct or indirect effects on the physical, chemical, and biotic environment. We describe the Action Area within the spatial extent of effects from those actions. Therefore, we include the marine transit route (MTR) proposed in the RFD in the described Action Area.

Effect Determinations for Species Not Likely to Be Adversely Affected: We identify those species and designated critical habitats that are “not likely to be adversely affected” and detail our effects analyses for these species and critical habitats.

Status of Species and Designated Critical Habitat: We identify the ESA-listed species and designated critical habitats that are “likely to be adversely affected” by the proposed action and evaluate the status of those species and habitats.

Environmental Baseline: We provide an analysis of the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat cause by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Consequences from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the baseline.

Effects of the Action: We provide an analysis of the effects of the action on listed species and critical habitat. Effects of the action are all consequences to listed species or designated critical habitat that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

Because the proposed action is long-term and some details that may influence potential effects to ESA-listed species are currently unknown, the effects analyses herein is conducted at a broad scale. The effects analyses for those activities that are likely to adversely affect ESA-listed species or designated critical habitat are general because many of these activities will require step-down consultations as details are provided by the BLM, as new lease sales are held within the Action Area, and as Marine Mammal Protection Act (MMPA) authorizations are requested by lessees.

Cumulative Effects: Cumulative effects considered in this section include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. When analyzing cumulative effects of a proposed action, we define both the spatial (geographic), and temporal (time) boundaries.

Conclusion: With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the Action Area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or,

- Appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives. See 50 C.F.R. §402.14(h)(3).

Incidental Take Statement: Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action, is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of the ITS.

Incidental take is not authorized for any species through this framework programmatic consultation or BO. Any incidental take resulting from any action subsequently authorized, funded, or carried out under the Proposed Program will be addressed in subsequent section 7 consultation, as appropriate. ITSs included in future step-down formal consultations would enumerate take, and include reasonable and prudent measures (RPMs), and terms and conditions to implement RPMs, to minimize impacts of take (ESA section 7 (b)(4); 50 C.F.R. §402.14(i)).

3. DESCRIPTION OF THE PROPOSED ACTION

3.1 Proposed Action

Programmatic framework consultation allows the BLM and the Service to conduct formal consultation in stages to maximize the opportunity for both agencies to more accurately evaluate potential effects of this Program on listed species and critical habitat by considering specific details of activities when they are proposed (e.g., through submission of a specific development plan to the BLM).

The first phase of this consultation includes the proposed Lease Sale and one or more additional lease sales held under the Proposed Program, and all on-lease activities associated with exploration and delineation of a first hypothetical anchor field, up to and including a commercially viable oil and gas discovery. The BLM describes that all on-lease activities that would occur after the initial anchor field discovery are components of future Program phases and would be subject to ESA section 7 consultation in future project-specific proposed development plans. These future Program activities could include development and production of additional anchor fields, further exploration, development, and production of satellite fields, and their decommissioning.

In order to assess potential impacts to listed species that may result from the proposed Lease Sale, the BLM developed a hypothetical Reasonably Foreseeable Development (RFD; BLM 2018a). This RFD, described in the Biological Assessment (BA), and Environmental Impact Statement (EIS) for the lease sale as Alternative B, with associated lease stipulations and Required Operating Procedures (ROPs), is summarized below. The reader should refer to the BLM’s BA and EIS for complete details.

3.1.1 Leasing

The Tax Cuts and Jobs Act of 2017 (Public Law 115-97) mandates that at least two oil and gas lease sales will occur within a portion of the Coastal Plain of Arctic Refuge. The first is to occur within 4 years, and the second within 7 years. It is assumed the first sale will occur within a year of publication of the Record of Decision (ROD) for the Leasing EIS. It is also assumed industry would lease the areas offered, and proceed with exploration and development schedule as quickly as the process allows.

Issuance of an oil and gas lease would not authorize ground disturbing activities; however, a lease would grant the lessee certain rights to drill and extract oil and/or gas subject to applicable regulations and lease stipulations. Therefore, the proposed Lease Sale is a prerequisite for subsequent permitting, and it is these subsequent actions, which require separate action by BLM, which have the potential for impacts to listed species and designated critical habitat. The BLM would not permit a lessee's subsequent on-lease activities until: 1) the lessee applies for appropriate BLM authorizations (e.g., application for permit to drill), 2) the lessee files a plan with site-specific details, and demonstrates compliance with the BLM stipulations and ROPs, 3) the BLM completes subsequent National Environmental Policy Act (NEPA) Analysis and ESA section 7 consultation for the proposed on-lease activity, and 4) the lessee demonstrates compliance with the MMPA, Clean Water Act, and/or other applicable requirements.

Subsequent to the first proposed Lease Sale, a sequence of activities could take place, each dependent on the success of the previous phase. These phases would include: 1) exploration for oil and gas resources (exploration), 2) construction of infrastructure (development), 3) extraction, processing, and transportation of resources (production), and 4) end of field life with decommissioning of wells, production facilities, and other infrastructure (abandonment). These phases are discussed in further detail under the hypothetical RFD below.

Surface Disturbance Limitations
Section 20001(c)(3) of PL 115-97 states that in administering this section, the Secretary shall authorize up to 2,000 surface acres of Federal land within the Program Area (i.e., the lands subject to the BLM's oil and gas leasing authority) to be covered by production and support facilities during the term of the leases under the Program.

3.1.2 Reasonably Foreseeable Development

The BLM has selected Alternative B from the Draft EIS as a hypothetical RFD (BLM 2018a). Under this alternative, the entire Program Area could be offered for lease sale (Figure 4.1). To minimize the chance that the impact analysis will understate potential impacts, the RFD assumes successful discovery and development, and optimistic high-production in a situation of favorable market prices. The BLM developed the proposed RFD based on assumptions from 1) previous two-dimensional seismic exploration of the Program Area, 2) the history of development in the National Petroleum Reserve Area (NPR-A) and other North Slope developments, 3) the BLM's knowledge of the almost entirely unexplored petroleum endowment of the Program Area, 4) current industry practices, and 5) professional judgment.

3.1.3 RFD Phase 1 – Exploration

The first project phase would include activities associated with exploration and delineation of an anchor field. Seismic surveys, exploratory drilling, and support activities associated with this phase are described in further detail below.

Seismic Surveys

The BLM assumes that the entire Program Area would be subject to a 3D seismic survey (BLM 2019b).[1] The BLM also assumes that after the first sale, lessees would conduct a smaller scale 3D survey on their own lease blocks (BLM 2019b). The area-wide and lease block-specific seismic surveys would be conducted via the same general methods. They would require travel by vibroseis seismic vehicles and smaller support vehicles. The vibroseis trucks are mounted on rubber tracks to minimize ground pressure. No air-guns or dynamite are expected to be used. Multiple vehicles could be used simultaneously miles apart to conduct vibroseis exploration, or convoys of four to five trucks could travel in a line, which is less common.

Cable-less geophone receivers (autonomous recording nodes) would be placed in lines perpendicular to source lines. Source and receiver lines would be typically 330 to 1,320 feet apart. Seismic operations would be accompanied by ski-mounted camp buildings towed by bulldozers or other tracked vehicles, such as Steigers. There could be two to three strings with four to eight modular buildings in each string. Camps are assumed to move weekly. Seismic exploration will be further detailed in the seismic environmental assessment, which is in preparation. All seismic operations would be conducted in the winter to minimize impacts on the tundra (BLM 2018a).

Exploratory Drilling

Based on results of the seismic surveys, exploratory wells would be drilled to confirm fields and define stratigraphic columns. Initial exploration wells would be drilled vertically to a depth of approximately 13,000 to 15,000 feet. Exploratory drilling would be conducted during winter months from ice pads constructed to support exploration operations. Exploration ice pads would typically be 1-foot thick and require 500,000 gallons of freshwater (DOI 2005). Freshwater for ice pad construction and drilling muds would likely be drawn from nearby lakes and/or rivers, or from snowmelt. Water demand would vary by the geology of individual sites and the density of drilling mud required.

Exploratory drilling operations would be self-contained (i.e., no reserve pits would be used to store drilling muds or cuttings). Drilling muds and cuttings would be crushed and slurried with seawater, then combined with the remaining drilling muds and reinjected into a confining rock formation 3,000 to 4,000 feet underground in an approved injection well (DOI 2005). Drilling an exploration well in a previously unexplored area may take weeks or months, depending on depth, data collection program, and borehole conditions. Once the well is completed, additional down-well testing and characterization could take up to a month (DOI 2005).

Following promising results with an exploration well, additional delineation wells may be drilled to further characterize the discovery. Delineation wells would require about the same time for drilling as an initial exploration well. After drilling, logging, and other downhole evaluation activities are complete, exploration and delineation wells would either be completed and

[1] While BLM's May 2019 Biological Assessment stated that an area-wide seismic survey would occur prior to the first lease sale, the expected timing of that activity has changed, and BLM subsequently provided the Service with supplemental information (BLM 2019b) expressing its updated assumption that an area-wide seismic survey would occur after the first lease sale.

suspended for future use, or plugged and abandoned according to regulatory requirements, with all wastes removed from the site (DOI 2005).

Transportation
Temporary winter routes, such as ice roads and packed snow trails, would facilitate exploratory activities. Ice roads would be constructed by removing water or ice chips from local permitted lakes and rivers, and spreading in the desired locations. Snow trails require sufficient snow depth for packing, and would generally only be suitable for tracked vehicles or wheeled transport of relatively small loads.

Winter ice roads and trail routes would depend on the location of the exploratory sites in proximity to developed areas (e.g., Point Thomson or Kaktovik) and the project-specific exploration plan. Transportation associated with exploration would be described and evaluated as part of the project-specific NEPA analysis and additional ESA consultation. Transportation of personnel and supplies during exploratory operations at remote locations in the Program Area would likely vary by season and phase of exploration and could include the use of aircraft (fixed-wing and helicopters).

3.1.4 RFD Phase 2 – Development

Following successful exploration and delineation, development and production plans for anchor and satellite fields would be expected. During development, the following activities are likely to occur:

- Construction, use, and maintenance of gravel infrastructure and facilities;
- Gravel mining;
- Pipeline installation;
- Continued exploratory drilling; and,
- Aircraft, vehicle, and vessel traffic.

Development
The RFD assumes development would start following discovery of the first anchor field, which would most likely be in the western half of the Program Area. Development would begin with construction of gravel pads for wells, central processing facility (CPF), airstrip, storage tanks, communications center, waste treatment unit, and worker camp. These facilities would occupy a total of 50 acres (BLM 2012; Table 3.1). See Figure 3.1 for a conceptual layout of a stand-alone oil development with an anchor field and associated facilities.

Construction and operation of up to four CPFs are predicted under the proposed RFD (Table 3.1). Additionally, about 17 satellite pads would be developed (approximately 4 satellite pads per CPF), and approximately 174 total miles of gravel road would connect these facilities (Table 3.1). Gravel roads would be less extensive than winter routes. Additionally, gravel roads would be limited to connecting production wells to CPFs. Precise estimates for gravel roads are unknown, although roads from similar oil and gas developments impact roughly 7.5 acres per mile (BLM 2012; Table 3.1). Up to 1,305 acres of surface disturbance are projected for gravel road construction, and this infrastructure would the greatest source of disturbance associated with the RFD (Table 3.1).

Following completion of the anchor pad, development would begin on satellite pads around the anchor field (Figure 3.1). Satellite pads would include production wells and required equipment to pump produced oil back to the nearest CPF via pipeline. Under the RFD, satellite pads are each anticipated to accommodate approximately 30 wells and impact roughly 12 acres (Table 3.1). Each satellite pad would require approximately 120,000 cubic yards of gravel. Pads would be constructed to a thickness (approximately 5-feet) sufficient to maintain a stable thermal regime, based on data from nearby Point Thomson (USACE 2012).

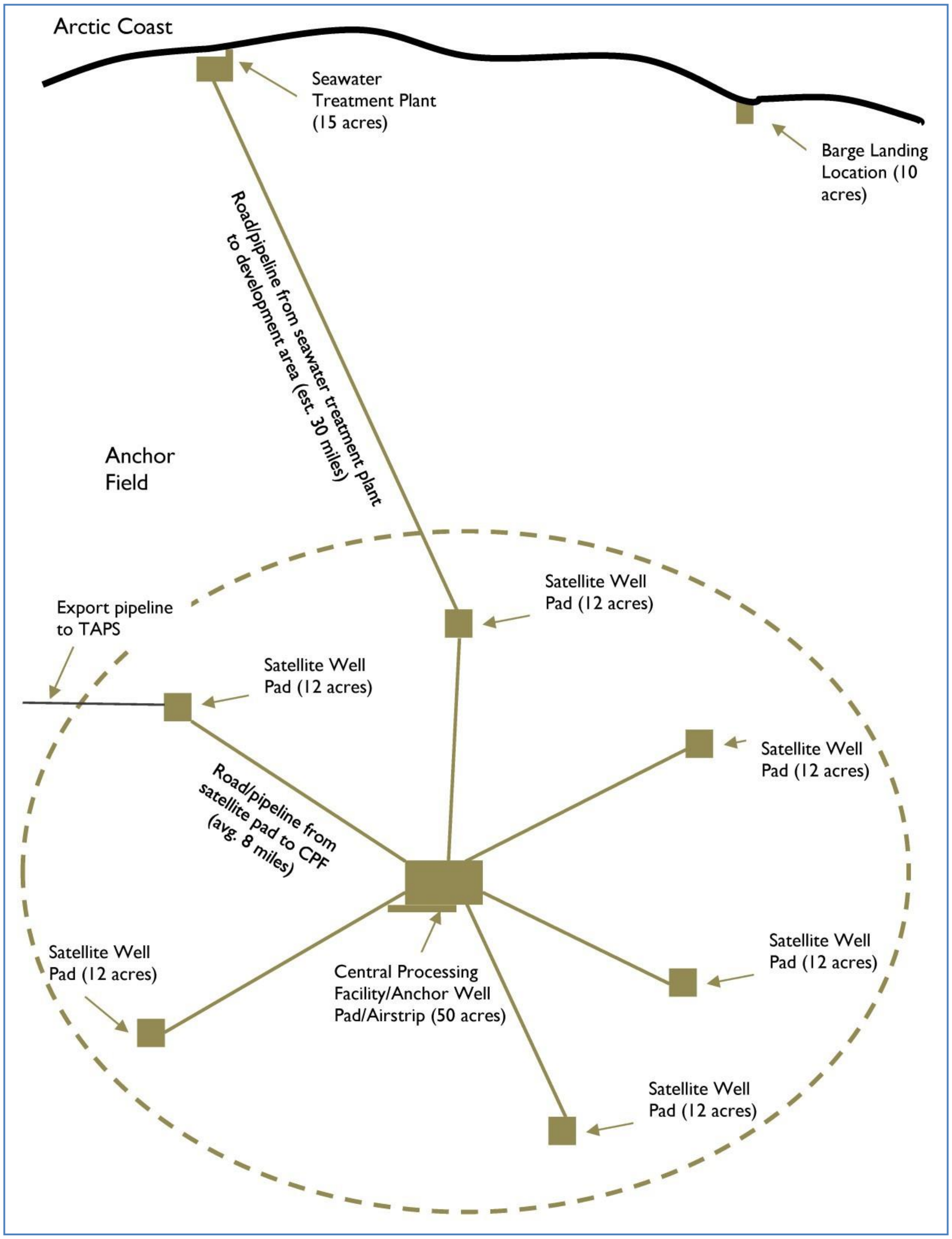

Figure 3.1 Conceptual layout of a hypothetical stand-alone oil development within the Action Area.

If necessary, a seawater treatment plant (STP) may also be constructed along the coast, to source saline water for water flooding, reservoir pressure, or other subsurface uses. The STP pad would be approximately 15 acres and require approximately 150,000 cubic yards of gravel (BLM 2012). A gravel access road and seawater transport pipeline would also be constructed from the STP to the CPF.

Table 3.1. Estimated surface disturbance by facility, and total disturbance area for up to 4 anchor fields projected under the RFD.

Facility Type	Number of Facilities	Disturbance area per single CPF (acres)	Total Federal Surface area disturbance (acres)
CPF, airstrip, anchor well pad	4	50	200
Satellite pads	14	12	168
Roads: CPF to satellites	174 miles	7.5 per mile	1,305
VSMs	212 miles	0.04 per mile	8
Seawater treatment plant	1	15	15
Barge landing and storage	1	10	10
Gravel mines	TBD[2]	TBD	300
Total (approximate)	N/A	480	2,000

Sources: BLM 2004, BLM 2012, USACE 2017

[1]All figures are general estimates and not based on specific project proposals. Acreages are approximate and rounded to the nearest acre.

[2]To be determined.

Material sites would be developed to supply gravel for pads and roads during the development phase. The BLM estimates between 12,600,000 and 12,900,000 cubic yards of gravel would be required to construct roads, airstrips and pads for a variety of purposes. Because a number of potential material sources occur in the Program Area, the BLM expects material sites would be constructed proximal to the infrastructure where it would be used. Therefore, additional gravel roads to access material sites are not expected.

Material sites would be excavated to between 25 and 50 feet in depth. With appropriate side slopes and areas for overburden storage, the BLM estimates approximately 165 to 320 acres of surface disturbance would be required to supply all RFD gravel needs for development.

Construction Access and Transportation

As with Phase 1 – Exploration, temporary winter routes, e.g., ice roads and packed snow trails, would be the primary travel corridors for heavy equipment and conventional vehicles during the development phase. Winter trails would be built within and beyond leased areas connecting work sites with existing infrastructure.

Ice roads would be used to transport supplies, drill rigs, modular units, and other large or heavy equipment for CPFs. Ice roads for development would be constructed by compacting snow using low-ground pressure vehicles (approximately 1 to 2 pounds per square inch). Compacted tracks capture more wind-blown snow and tracks are again compacted after roughly a week. Once accumulation is complete, larger tracked vehicles with higher ground pressure or wheeled vehicles, such as a water truck or front-end loader, compact the snow to the desired road width. Water is then dispersed on the compacted snow to create ice buildup. Minimum ice road thickness would be 6 inches, and roads are typically 35 feet wide. Ice road construction would require approximately 1 million gallons of water per mile, although use of ice chips could reduce liquid water use substantially. About 1 mile of ice road could be constructed per day (BLM 2012).Ice roads would be constructed each winter to transport larger or heavier supply items to anchor fields. Any equipment or supplies not transported during the winter would be flown in with aircraft. Because the anchor fields would be separated from other North Slope infrastructure, additional flights would be necessary, compared to a road-supported development.

Snow trails could be used for smaller equipment, such as seismic trucks, camps, and maintenance vehicles. Low-ground pressure vehicles would pre-pack snow, groom, and maintain trails when necessary. Snow trails would be thinner than ice roads and wide enough for one vehicle only. Precise estimates of the length of winter routes are unknown.

Barging – The RFD assumes marine transportation would occur during development to facilitate construction. During the open-water season (July – October), lessees would use barges to transport large equipment (e.g., a drilling rig), construction materials, and supplies from Dutch Harbor to a barge landing on the Coastal Plain of Arctic Refuge. An average of two barge transports per year are anticipated (BLM DEIS 2018). The MTR would occur along an established shipping route (Figure 4.2).

Aircraft – Fixed-wing aircraft and helicopters could also be used throughout the Action Area to deliver staff, construction materials, and equipment to work sites. Aircraft use could occur year-round.

3.1.5 RFD Phase 3 – Production

Production drilling

Following construction of gravel pads and thoroughfares, facility construction and production drilling would begin. Each anchor pad, and associated CPF, would be the long-term operational center for production activities in an anchor field, and it would include equipment for processing oil, gas, and water, as follows:

- Separators for oil, gas, and water, with an output of sales-quality oil;
- Filtration of produced oil to extract solids;
- Processing of associated gas to remove water and natural gas liquids, followed by gas compression and reinjection into the reservoir through gas injection wells;
- Reinjection of water into the reservoir; and,
- Compressors for gas and pumps for water injection.

In addition to the CPF, a generator, storage tanks, communications center, waste treatment units, and a maintenance shop would be constructed on the anchor pad. Fuel for equipment operation would be hauled overland. Living quarters and offices may or may not be co-located on the anchor pad. All buildings would be supported aboveground on pilings to accommodate ground settling or frost heaving.

Production wells would extend horizontally in the target formation and approximately eight wells would be drilled per year. Therefore, about 4 years would be required to drill a total of 30 wells on the average pad. Depending on drill rig availability, drilling could take place on multiple well pads at the same time. Drilling each well would require from 420,000 to 1.9 million gallons of water (BLM 2012). Wells would be hydraulically fractured for initial stimulation; however, this process requires less water than the multi-stage hydraulic fracturing used in unconventional reservoirs. Water flooding using parallel injection wells would increase oil recovery by pushing oil toward producer wells and maintain reservoir pressure. Water demand for maintaining reservoir pressure would be proportional to oil production from the field. For example, a field that produces 50,000 barrels of oil per day would require approximately 2 million gallons of water per day.

The anchor pad would also have a Class I and/or Class II injection well to dispose of industrial wastes and fluids associated with oil and gas production (EPA 2018). Solid, unburnable waste would be disposed of in large trash receptacles or other approved containers and hauled to approved, off-site landfills. On-site burial of solid wastes is not anticipated.

Pipeline construction and maintenance
A production pipeline would be constructed to connect each CPF to the Trans-Alaska Pipeline System (TAPS) to move oil to market. Installation of VSMs would impact approximately 0.04 acres of tundra per mile of pipeline (USACE 2017; Table 3.1). Pipelines would also connect satellite pads to the nearest CPF. Pipelines for water, fuel, and electric cables would be run on the same VSMs connecting the CPF to satellite pads. Approximately 250 miles of pipeline would be constructed in the Program Area under the RFP, impacting up to 10 acres of surface area (Table 3.1).

Transportation
Most equipment for the production phase, including CPF modules, would be transported to the anchor field on ice roads from a barge landing. Camden Bay is the most likely location for a barge landing (DOI 1987), although lessees may also use existing landing facilities at Point Thomson. A barge landing and staging pad, impacting roughly 10 acres total, would be constructed to store equipment and modules until ice roads can be constructed (Figure 3.1). During the production phase, winter routes would also be used for pipeline maintenance.

Production
Once all wells in a development are operational, production is anticipated to peak at 100,000 barrels per day from each field, after 3 years. From that point on, production is estimated to decline at a rate of approximately 8 percent per year. Produced oil would be processed at the CPF to separate water and gas from salable oil and natural gas. Water and gas would be reinjected into the formation to enhance oil recovery, and gas would be vented or flared only in emergency situations. Oil would be shipped to market via TAPS.

Production operations would involve resupply of materials and personnel, inspections, maintenance, and repair. Maintenance and repair work would be required to keep production and service wells operational. Well workovers would likely be made at 5-10 year intervals to restore production flow rates. Pipelines would be inspected and cleaned regularly using internal pipe inspection gauges. Personnel would be rotated at regular intervals. Depending on market forces, the size and number of fields discovered, and the timing of development, ultimate recovery in the Program Area is estimated to be from 1.5 to 10 billion barrels of crude oil. Field production would be expected to last from 10 to 50 years before abandonment (BLM 2012). Assuming a 100,000 barrel-per-day peak production and 8 percent decline per year, it would take an estimated 35 years after reaching peak production reach the point of field abandonment.

Natural Gas Development

Until a transportation system to move gas to market is constructed, it is assumed that comingled gas produced with oil would be separated and reinjected into the formation as part of the reservoir enhanced recovery process. Future installation of a natural gas pipeline along the TAPS corridor, while not part of BLM's proposed action, would be expected to facilitate the production of sales gas from Program Area leases. The RFD thus assumes that natural gas production could occur from leases issued under the Proposed Program. Gas processing and compression facilities would be co-located with existing oil CPFs, and would comprise approximately 13 acres of additional ground disturbance per each of those four assumed CPFs. Two types of natural gas pipelines would be installed in the Program Area: gathering pipelines to convey unprocessed natural gas from wellheads to the four CPFs, and a larger diameter pipeline to convey processed natural gas from the Program Area to the natural gas pipeline along the TAPS corridor. All of the pipelines associated with the Proposed Program would be expected to be installed on the same VSMs as existing oil pipelines, and therefore additional surface area impacts from gas pipelines would not be expected. Meanwhile, BLM has clarified that installation and operation of a natural gas pipeline to Kaktovik is neither part of the proposed action nor otherwise reasonably certain to occur (email from BLM dated October 23, 2019).

3.1.6 RFD Phase 4 – Abandonment and Reclamation

During decommissioning and abandonment, production and injection wells would be plugged with cement to prevent fluid migration between formations, and well casings would be cut, plugged below the surface, and buried. All equipment, facilities, and solid waste would be removed from gravel pads and roads. Pipelines and VSMs would be removed and scrapped or reused in other developments. Gravel from roads and pads would be removed and reused in other areas, or placed back in material sites. Gravel pits that are not refilled would be reclaimed as wildlife ponds.

Before final abandonment, land used for oil and gas infrastructure, including well pads, production facilities, access roads, and airstrips; would be reclaimed. Lessees would develop and implement BLM-approved abandonment and reclamation plans. Reclamation plans would describe short-term stability, visual, hydrological, and productivity objectives and required steps to ensure eventual restoration of previous hydrological, vegetation, and habitat condition.

3.1.7 RFD Schedule

Table 3.2 describes general time frames in which hypothetical exploration, development, and production might occur in the Program Area. Activities projected to occur within 5 years after signing of the ROD are considered short term; activities occurring more than 5 years from ROD signature are considered long term.

Exploration Schedule

Exploration would begin within 2 years of signing of the ROD, with a permit application submitted for the first exploration well. Following successful discovery with the first exploration well, additional seismic exploration and delineation wells would be drilled from years 4 through 6. Continued exploratory activities may be concurrent with formulation of a development plan and an EIS (Table 3.2).

Development Schedule

Development of the first anchor field would begin approximately 7 years post-Lease Sale. Additional anchor and satellite fields would likely continue to be developed in years 11 to 85 and may continue producing through year 85. The BLM assumes most development activities associated with an anchor field and satellite fields would occur in year 7 through year 85 (Table 3.2).

Production Schedule

The BLM anticipates production activities on the first anchor pad would begin in approximately year 8 and continue until year 85, with peak production expected in years 9 to 40 (Table 3.2). Once peak production is reached, production from a field is anticipated to continue for up to another 35 years, depending on resource production, market forces, and operator financial decisions; therefore, it could be 85 years or more after the first Lease Sale before all developments reach the end of field life (Table 3.2). However, just as development is expected to occur in phases, reclamation would occur in phases. The first field to be developed could be reclaimed long before the last field is abandoned.

Abandonment and reclamation schedule

Decommissioning, abandonment, and reclamation would occur from year 19 to 130 after oil and gas reserves at a given development are depleted and/or production income no longer pays operating expenses (Table 3.2). Typically, abandonment and reclamation of oil and gas infrastructure could take from 2 to 5 years, or longer, following termination of production (BLM 2012).

Table 3.2. Estimated hypothetical schedule for the proposed lease sale and RFD within the Program Area (BLM 2018; 2019b).

Project Phase	Time from ROD Signature	Activities
Initial 3D seismic exploration	Within 2 years of ROD	Area-wise 3D seismic exploration
Leasing	Within 1 year of ROD	First Lease Sale.
Exploration	2 years after ROD (winter)	First application for permit to drill submitted for exploration well. First exploration well drilled, assumes discovery with first exploration well.
Additional lease-level seismic Exploration	Within 3 years after 1st Lease Sale (winter)	Seismic exploration on lease block with discovery to locate future delineation exploration wells. Process seismic data and determine location of delineation wells to be drilled the following winter.
Additional exploration wells	4 years after ROD (winter)	Drill 3 to 5 additional wells to define the prospect and identify satellite pad locations.
Master development plan and EIS	5 to 6 years after ROD	Conduct NEPA analysis on master development plan for anchor field. Continue drilling 2 to 3 exploration wells to identify CPF and satellite pad locations.
Development	7 years after ROD	Begin laying gravel for anchor pad and begin CPF construction. Continue drilling 2 to 3 exploration wells to identify satellite pad locations. Begin drilling production wells on anchor pad.
Production begins	8 years after ROD	First production from anchor pad. Winter gravel and construction on satellite pads.
Peak production	9 to 40 years after ROD	All wells completed on anchor pad. All wells completed on satellite pads.
Development of additional fields	11 to 85 years after ROD	Construct facilities and drill wells in additional fields. Production continues for approximately 35 years after reaching peak production in each field.
Abandonment and Reclamation	19 to 130 years after ROD	Plug wells that are no longer economically productive. Remove retired equipment, dig up vacant gravel pads and roads and reclaim the area.

3.1.8 Project design criteria

During this framework programmatic consultation, the Service and the BLM developed and agreed upon four PDCs designed to minimize and monitor effects of the proposed Program to polar bears (and other listed species) and to describe how compliance with section 7(a)(2) of the ESA will be ensured. The first two are also Lease Notices that will be issued in writing by the BLM to all lessees[2], and intend to provide notice that all future activities to be authorized under the Program will be required to comply with the MMPA and ESA. The third and fourth PDCs are procedures developed and agreed to by the BLM and the Service to be used when jointly managing the framework program as step-down consultations on future proposed activities are conducted. These measures are considered part of the BLM's Proposed Program and figure prominently in our evaluation of its potential effects in *Section 8,* below.

PDC 1. Section 7 Consultation on Future Activities – The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened or endangered. The BLM would not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the ESA, as amended (16 United States Code [USC] 1531 et seq.), including completion of any required procedure for conference or consultation.

PDC 2. The lease area and/or potential project areas may now or hereafter contain marine mammals. The BLM may require modifications to exploration and development proposals to ensure compliance with Federal laws, including the Marine Mammal Protection Act (MMPA). The BLM would not approve any exploration or development activity absent documentation of compliance under the MMPA. Such documentation shall consist of a Letter of Authorization, Incidental Harassment Authorization, and/or written communication from USFWS and/or NMFS confirming that a take authorization is not warranted,

PDC 3. The Service and the BLM will conduct programmatic reviews by meeting at least annually beginning one year after the first Lease Sale. These reviews will evaluate, among other things, 1) whether activities proposed are consistent with the RFD, as described, for the Proposed Program, 2) whether the nature and scale of predicted effects remain valid, and 3) whether the programmatic consultation, including the PDCs and determinations reached, remain adequate and appropriate. In addition, these meetings will provide a venue where any new information on the status of species, their critical habitat, or new methods to avoid or minimize impacts can be shared.

PDC 4. All activities, including plan development, study development, and consideration of exceptions, modifications, or waivers would include coordination with the USFWS as the surface management agency and would comply with the ESA. In addition, the BLM would coordinate with other appropriate federal, state, and North Slope Borough agencies, tribes, and Alaska Native Claims Settlement Act corporations.

[2] The requirements of Lease Notices 1 and 2, which form the basis of PDCs 1 and 2, will also apply to any exploration and development actions that are not dependent on an oil and gas lease (e.g., the area-wide seismic survey in the June updates to the BA [BLM 2019b]), in the same manner the Notices would apply to lease-based activities (BLM email dated October 23, 2019).

3.1.9 Minimization measures

Other minimization measures associated with the Proposed program and all associated lease sales include lease stipulations, ROPs[3], and lease notices committed to by the BLM in their BA and Draft EIS (BLM 2018a; 2019a; 2019b) to avoid and minimize potential adverse effects on ESA-listed species and designated critical habitat. Each of these protective measures is described in detail below. These measures, when applied to activities associated with the Lease Sale and RFD, would minimize effects to ESA-listed species and designated critical habitat. Although many of the following measures apply broadly to "marine mammals," we identify that this terminology also applies to ESA-listed polar bears and sea otters.

A BLM Authorized Officer (AO) may authorize a modification to a lease stipulation only if they determine that factors leading to the stipulation have changed sufficiently to render the stipulation unjustified; the proposed operation would still be required to meet the stated objective of the stipulation. While the BLM may grant a waiver[4], exception, or modification of a stipulation through the permitting process, but only after successfully completing section 7 consultation with the Service.

Coastal Plain Lease Stipulations

Lease stipulations are requirements added to the lease as contractual obligations that lessees must follow. Timing limitations (TLs) and no surface occupancy (NSO) provisions are two of the mechanisms by which lease stipulations would minimize impacts of the proposed Program. TLs are applicable to fluid mineral leasing, all activities associated with fluid mineral leasing, for example, truck-mounted drilling, geophysical exploration off designated routes, construction of wells and pads, well workovers, and other surface-disturbing activities. Areas identified for TLs are closed to fluid mineral exploration and development, surface-disturbing activities, and intensive human activity during identified time frames. Such stipulations would not apply to operation and basic maintenance, including associated vehicle travel, unless otherwise specified. The TLs can overlap spatially with CSU and NSO areas, as well as with areas without other restrictions.

NSO areas would be open for mineral leasing. However, in order to protect other resource values construction of surface oil and gas facilities would not be allowed. Essential activities, such as pipelines, barge landings, and road crossings, would be permitted on a case-by case basis.

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[3] All proposed ROPs will apply to any exploration and development actions that are not dependent on an oil and gas lease (e.g., the area-wide seismic survey contemplated in the June updates to the BA [BLM 2019b]), in the same manner the ROPs would apply to lease-based activities (BLM email dated October 23, 2019).

[4] Lease stipulations for the Program may be altered in the following ways as deemed appropriate by a BLM AO: 1) a waiver (a permanent exemption to a lease stipulation); 2) an exception (a one-time exemption to a lease stipulation, determined on a case-by-case basis); and 3) a modification (a change to a lease stipulation, either temporary or for the duration of the lease).

The following lease stipulations would reduce Program-related impacts to ESA-listed species and/or designated critical habitat, and are a subset of those stipulations that would apply to leases issued pursuant to the Proposed Program:

1. **Rivers and Streams**. Objective: Minimize the disruption of natural flow patterns and changes to water quality, the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas, the loss of spawning, rearing, or overwintering fish habitat, the loss of cultural and paleontological resources; the loss of raptor habitat, impacts on subsistence cabins and campsites, and the disruption of subsistence activities. Protect the water quality, quantity, and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the Coastal Plain.

   Requirement/Standard: (NSO) Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within the described setback distances outlined below, from the southern boundary of the Coastal Plain to the stream mouth. For streams that are entirely in the Coastal Plain, the setback extends to the head of the stream, as identified in the National Hydrography Dataset. On a case-by case basis, essential pipeline and road crossings, and barge landings would be permitted through setback areas. The setbacks may not be practical in river deltas; in these situations, permanent facilities would be designed to withstand a 200-year flood.

   a. Canning River: from the western boundary of the Coastal Plain to 1 mile east of the eastern edge of the active floodplain
   b. Hulahula River: 1 mile in all directions from the active floodplain
   c. Aichilik River: 1 mile from the eastern edge of the Coastal Plain boundary
   d. Okpilak River: 1 mile from the banks' ordinary high-water mark
   e. Jago River: 1 mile from the banks' ordinary high-water mark
   f. The following rivers and creeks will have a 0.5-mile setback from the banks' ordinary high-water mark:
      i. Sadlerochit River
      ii. Tamayariak River
      iii. Okerokovik River
      iv. Katakturuk River
      v. Marsh Creek

2. **Canning River Delta and Lakes**. Objective: Protect and minimize adverse effects on the water quality, quantity, and diversity of fish and wildlife habitats and populations, subsistence resources, and cultural resources; protect and minimize the disruption of natural flow patterns and changes to water quality, the disruption of natural functions resulting from the loss or change to vegetation and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing, or overwintering habitat for fish; the loss of cultural and paleontological resources; and the loss of migratory bird habitat.

   Requirement/Standard: Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas 4 feet deep or less during winter and withdrawal of water from lakes during the summer may be authorized on a site-specific basis, depending on water volume and depth, the fish community, and connectivity to other lakes or streams.

3. **Springs/Aufeis**. Objective: Protect the water quality, quantity, and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the Coastal Plain. River systems with springs provide year-round habitat and host the most diverse and largest populations of fish, aquatic invertebrates, and wildlife; they are associated with major subsistence activity and cultural resources. An aufeis is a unique feature associated with perennial springs. It helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could be disturbed by drilling or fracking, use buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.

   Requirement/Standard: Before drilling, the lessee/operator/permittee would conduct studies in areas containing springs to ensure drilling would not disrupt flow of the perennial springs, unless such studies have already been completed. Study plans would be developed in consultation with the BLM, the Service, and other agencies, as appropriate. See Lease Stipulation 1 for additional requirements/standards.

4. **Nearshore marine, lagoon, and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic Refuge**. Objective: Protect fish and wildlife habitat, including that for waterfowl and shorebirds, caribou insect relief, marine mammals, and polar bear summer and winter coastal habitat; preserve air and water quality; and minimize impacts on subsistence activities, recreation, historic travel routes, and cultural resources on the major coastal water bodies.

   Requirement/Standard: Lessees would be subject to no surface occupancy (NSO) restrictions for exploratory well drill pads, production well drill pads, or a CPF for oil or gas would not be permitted in coastal waters, lagoons, or barrier islands within the boundaries of the Coastal Plain.

   a. The BLM Authorized Officer may approve infrastructure necessary for oil and gas activities in these critical and sensitive coastal habitats, such as barge landing, docks, spill response staging and storage areas, and pipelines. Approval would be on a case-by-case basis, in consultation with the USFWS or NMFS or both, as appropriate.

   b. All lessees/operators/contractors involved in authorized activities in the coastal area must coordinate construction and use infrastructure with all other prospective Arctic Refuge users or user groups. Before conducting open water activities, the lessee/operator/contractor would consult with the Alaska Eskimo Whaling Commission, the NSB, and local whaling captains' associations to minimize impacts on subsistence whaling and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil and gas infrastructure in the coastal area, the lessee/operator/contractor would develop and implement an impact and conflict avoidance and monitoring plan. This would be used to assess, minimize, and mitigate the effects of the infrastructure and its use on these coastal area habitats and their use by wildlife and people, including the following:

i. Design and construct facilities to minimize impacts on subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
ii. Daily operations, including use of support vehicles, watercraft, and aircraft, alone or in combination with other past, present, and reasonably foreseeable activities, would be conducted to minimize impacts on subsistence and other public uses, travel corridors, and seasonally concentrated fish and wildlife resources.
iii. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, would be sited and constructed to not pose a hazard to public navigation, using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays, as identified by the community of Kaktovik and the NSB.
iv. Operators would be responsible for developing comprehensive prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans (SPCCP) and maintain adequate oil spill response capability to effectively respond during periods of broken ice or open water, based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), as well as best management practices, stipulations, and policy guidelines of the BLM.

5. **Coastal Polar Bear Denning River Habitat**. Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.

   Requirement/Standard: This lease stipulation minimizes disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas by requiring the lessee comply with ESA and Marine Mammal Protection Act (MMPA) requirements.

6. **Caribou Summer Habitat**. Objective: Minimize disturbance and hindrance of caribou or alteration of caribou movements.

   Requirement/Standard: Facilities would be designed and located to minimize the development footprint and impacts on other purposes of the Arctic Refuge. Issues and methods that are to be considered are as follows:

   a. Using maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads
   b. Sharing facilities with existing development

c. Collocating all oil and gas facilities with drill pads, except airstrips, docks, base camps, and seawater treatment plants (STPs)
d. Using gravel-reduction technologies, e.g., insulated or pile-supported pads
e. Using impermeable liners under gravel infrastructure to minimize the potential for hydrocarbon spills
f. Harvesting the tundra organic layer within gravel pad footprints for use in rehabilitation
g. Coordinating facilities with infrastructure in support of adjacent development
h. Locating facilities and other infrastructure outside areas identified as important for wildlife habitat, subsistence uses, and recreation
i. Where aircraft traffic is a concern, balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations

7. **Porcupine Caribou Primary Calving Habitat Area**. Objective: Minimize disturbance and hindrance of caribou or alteration of their movements in the south-southeast portion of the Coastal Plain, which has been identified as important caribou habitat during calving.

   Requirement/Standard: (TL) Major construction activities using heavy equipment, but not drilling from existing production pads, would be suspended in the Porcupine caribou herd (PCH) primary calving habitat area from May 20 through June 20, unless approved by the BLM Authorized Officer, in consultation with the appropriate federal, State, and NSB regulatory and resource agencies. These areas encompass approximately 721,200 acres. If caribou arrive on the calving grounds before May 20, major construction would be suspended. The lessee should submit with the development proposal a stop work plan that considers this, and any other mitigation related to caribou early arrival. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.

8. **Porcupine Caribou Post-Calving Habitat Area**. Objective: To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities in areas used by caribou during post-calving and insect-relief periods.

   Requirement/Standard: Facilities would be designed and located to minimize the development footprint and impacts on other purposes of the Arctic Refuge.

9. **Coastal Area.** Objective: Protect coastal waters, lagoons, barrier islands, shorelines, and their value as fish and wildlife habitat, including for waterfowl, shorebirds, and marine mammals; minimize the hindrance or alteration of caribou movement in caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear use and movement in coastal habitats; protect and minimize disturbance from oil and gas activities to coastal habitats for polar bears and seals; prevent loss and alteration of important coastal bird habitat; and prevent impacts on coastal subsistence resources and activities.

Requirement/Standard: Before beginning exploration or development within 2 miles of the coast, the lessee/operator/contractor would develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these coastal habitats and their use by wildlife and people.

3.1.10 Required Operating Procedures

Required Operating Procedures (ROPs) are additional protective measures that the BLM would impose on all applicants during the permitting process (i.e., project-specific measures for future project phases). At the permitting stage, the BLM AO would not include ROPs that, because of their location or other inapplicability, are not relevant to a specific permit application. Note also that at the permit stage, the BLM AO may establish additional requirements as warranted to protect the land and resources, in accordance with the BLM's responsibility under relevant laws and regulations. Described below are ROPs that apply protective measures for ESA-listed species and/or designated critical habitat.

ROP 1
Objective: Protect public health, safety, and the environment by disposing of solid waste and garbage, in accordance with applicable federal, State, and local laws and regulations.

Requirement/Standard: Areas of operation would be left clean of all debris.

ROP 2
Objective: Minimize impacts on the environment by reducing the attraction, particularly bears, to human use areas.

Requirement/Standard: Lessee/operator/contractor would prepare and implement a comprehensive waste management plan for all phases of exploration, development, and production, including seismic activities. The plan would include methods and procedures to use bear resistant containers for all waste materials.

ROP 3
Objective: Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.

Requirement/Standard: Refueling equipment within 100 feet of the active floodplain of any waterbody is prohibited. Fuel storage stations would be located at least 100 feet from any waterbody, except for small caches (up to 210 gallons) for motor boats, float planes, and ski planes, and for small equipment, such as portable generators and water pumps. The BLM Authorized Officer may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.

ROP 4
Objective: Minimize conflicts from the interaction between humans and bears during oil and gas activities.

Requirement/Standard: The lessee/operator/contractor, as a part of lease operation planning, would prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These bear interaction plans would be developed in consultation with and approved by the USFWS and the Alaska Department of Fish and Game (ADF&G). The plans would include specific measures similar to those measures identified in the current USFWS Incidental Take Regulations (81 FR 52318; § 18.128) that have been promulgated and applied to petroleum activities to the west of the Coastal Plain. Plans would be adapted as needed for grizzly bears. These plans must include:

- The type of activity and where and when the activity will occur (i.e., a plan of operation);
- A food, waste, and other ‘‘bear attractants’’ management plan;
- Personnel training policies, procedures, and materials;
- Site-specific polar bear interaction risk evaluation and mitigation measures;
- Polar bear avoidance and encounter procedures; and
- Polar bear observation and reporting procedures.

ROP 10
Objective: Protect polar bear denning locations.

Requirement/Standard: All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1 mile of known or observed polar bear dens, unless alternative protective measures are approved by the BLM Authorized Officer and are consistent with the MMPA and the ESA.

ROP 15
Objective: Reduce changes in snow distribution associated with the use of snow fences to protect water quantity and wildlife habitat, including snow drifts used by denning polar bears.

Requirement/Standard: The use of snow fences to reduce or increase snow depth requires permitting by the BLM Authorized Officer.

ROP 17
Objective: Minimize surface impacts from exploratory drilling.

Requirement/Standard: Construction of gravel roads and pads would be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.

ROP 21
Objective: Minimize impacts of the development footprint.

Requirement/Standard: Facilities would be designed and located to minimize the development footprint and impacts on other purposes of the Arctic Refuge.

a. Using maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads
b. Sharing facilities with existing development

c. Collocating all oil and gas facilities with drill pads, except airstrips, docks, base camps, and seawater treatment plants (STPs)
d. Using gravel-reduction technologies, e.g., insulated or pile-supported pads
e. Using impermeable liners under gravel infrastructure to minimize the potential for hydrocarbon spills
f. Harvesting the tundra organic layer within gravel pad footprints for use in rehabilitation
g. Coordinating facilities with infrastructure in support of adjacent development
h. Locating facilities and other infrastructure outside areas identified as important for wildlife habitat, subsistence uses, and recreation
i. Where aircraft traffic is a concern, balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations

ROP 24
Objective: Minimize the impact of mineral materials mining on air, land, water, fish, and wildlife resources.

Requirement/Standard: Gravel mine site design and reclamation would be done in accordance with a plan approved by the BLM Authorized Officer.

ROP 25
Objective: Avoid human-caused changes in predator populations of ground-nesting birds.

Requirement/Standard:
a. Lessee/operator/contractor would use best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee/operator/contractor would provide the BLM Authorized Officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites.
b. Feeding of wildlife and allowing wildlife to access human food or odor-emitting waste is prohibited.

ROP 26
Objective: Reduction of risk of attraction and collisions between migrating birds and oil and gas and related facilities during low light conditions.

Requirement/Standard: All structures would be designed to direct artificial exterior lighting, from August 1 to October 31, inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.

ROP 27
Objective: Minimize the impacts to bird species from direct interaction with oil and gas facilities.

Requirement/Standard:
a. To reduce the possibility of birds colliding with aboveground utility lines (power and communication), such lines would either be buried in access roads or would be suspended on

vertical support members, except in rare cases, limited in extent. Exceptions are limited to the following situations:

b. To reduce the likelihood of birds colliding with them, communication towers would be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures and on the east or west side of buildings or other structures, if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, would be avoided to the extent practicable. If support wires are necessary, they would be clearly marked along their entire length to improve visibility to low-flying birds. Such markings would be developed through consultation with the USFWS.

ROP 28

Objective: Use ecological mapping as a tool to assess wildlife habitat before developing permanent facilities to conserve important habitat types.

Requirement/Standard: An ecological land classification map of the area would be developed before approval of facility construction.

ROP 32

Objective: Avoid and reduce temporary impacts on productivity from disturbance near Steller's or spectacled eider nests.

Requirement/Standard: Ground-level vehicle or foot traffic within 656 feet of occupied Steller's or spectacled eider nests, from June 1 through July 31, would be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 656 feet of occupied Steller's or spectacled eider nests would be prohibited. Between June 1 and August 15, support/construction activity must occur off existing thoroughfares, and USFWS-approved nest surveys must be conducted during mid-June before the activity is approved. Collected data would be used to evaluate whether the action could occur based on a 656-foot buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. The BLM would also work with the USFWS to conduct nest surveys or oil spill response training in riverine, marine, and intertidal areas that is within 656 feet of shore outside sensitive nesting/brood-rearing periods. The protocol and timing of nest surveys for Steller's or spectacled eiders would be determined in cooperation with and must be approved by the USFWS. Surveys would be supervised by biologists who have previous experience with Steller's or spectacled eider nest surveys.

ROP 34

Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, local communities, and recreationists of the area, including hunters and anglers.

Requirement/Standard: The operator would ensure that operators of aircraft used for permitted oil and gas activities and associated studies maintain altitudes according to the following guidelines:

a. Land users would submit an aircraft use plan as part of an oil and gas exploration or development proposal, which includes a plan to monitor flights and includes a reporting system for subsistence hunters to easily report flights that disturb subsistence harvest. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies would be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas would be considered to allow larger aircraft to be used, resulting in fewer flights to the facility.

b. Pursuing running wildlife is hazing. Hazing wildlife by aircraft pilots is prohibited, unless otherwise authorized. If wildlife begins to run as an aircraft approaches, the aircraft is too close and the operator must break away.

ROP 46

Objective: Minimize impacts on marine mammals from vessel traffic.

Requirement/Standard:

I. General Vessel Traffic

a. Operational and support vessels will be staffed with dedicated PSOs to alert crew of the presence of marine mammals and to initiate adaptive mitigation responses.

b. When weather conditions require, such as when visibility drops, support vessel operators must reduce speed and change direction, as necessary (and as operationally practicable), to avoid the likelihood of injuring marine mammals.

c. The transit of operational and support vessels is not authorized before July 1. This operating condition is intended to allow marine mammals the opportunity to disperse from the confines of the spring lead system and minimize interactions with subsistence hunters. Exemption waivers to this operating condition may be issued by the NMFS and USFWS on a case-by-case basis, based on a review of seasonal ice conditions and available information on marine mammal distributions in the area of interest.

d. The transit route for the vessels will avoid NMFS-identified known fragile ecosystems.

e. Vessels may not be operated in such a way as to separate members of a group of marine mammals from other members of the group.

f. Operators should take reasonable steps to alert other vessel operators in the vicinity of marine mammals.

g. Operators should report any dead or injured listed marine mammals to NMFS and the USFWS.

h. Vessels will not allow tow lines to remain in the water, and no trash or other debris will be thrown overboard, thereby reducing the potential for marine mammal entanglement.

i. The lessee will implement measures to minimize risk of spilling hazardous substances. These measures will include: avoiding operation of watercraft in the presence of sea ice to the extent practicable and using fully-operational vessel navigation systems composed of radar, chart plotter, sonar, marine communication systems, and satellite navigation receivers, as well as Automatic Identification System (AIS) for vessel tracking.

II. Vessels in Vicinity of Whales

a. Vessel operators should avoid groups of 3 or more whales. A group is defined as being three or more whales observed within a 500-m (1641-ft) area and displaying behaviors of directed or coordinated activity (e.g., group feeding).

b. All nonessential boat and barge traffic would be scheduled to avoid periods when bowhead whales are migrating through the area to where they may be affected by sound from the project. Any non-essential boat, hovercraft, barge, or aircraft will be scheduled to avoid approaching the harvest area around Cross Island during the bowhead whale subsistence hunting consistent with the Conflict Avoidance Agreement (CAA).

c. If the vessel approaches within 1 mile of observed whales, except when providing emergency assistance to whalers or in other emergency situations, the operator would take reasonable precautions to avoid potential interaction with the whales by taking one or more of the following actions, as appropriate:

i. Reducing vessel speed to less than 5 knots within 300 yards of the whale

ii. Steering around the whale if possible

iii. Operating the vessel to avoid causing a whale to make multiple changes in direction

iv. Checking the waters around the vessel to ensure that no whales will be injured when the propellers are engaged

v. Reducing vessel speed to 9 knots or less when weather conditions reduce visibility to avoid the likelihood of injury to whales

vi. Vessels shall not exceed speeds of 10 knots in order to reduce potential whale strikes.

vii. If a whale approaches the vessel and if maritime conditions safely allow, the engine will be put in neutral and the whale will be allowed to pass beyond the vessel. If the vessel is taken out of gear, vessel crew will ensure that no whales are within 50 m of the vessel when propellers are re-engaged, thus minimizing risk of marine mammal injury.

d. Vessels will stay at least 300 m away from cow-calf pairs, feeding aggregations, or whales that are engaged in breeding behavior.

e. Consistent with NMFS marine mammal viewing guidelines (https://alaskafisheries.noaa.gov/pr/mm-viewing-guide), operators of vessels will, at all times, avoid approaching marine mammals within 100 yards. Operators will observe direction of travel and attempt to maintain a distance of 100 yards or greater between the animal and the vessel by working to alter course or slowing the vessel.

f. Special consideration of North Pacific right whale and their critical habitat:

i. Vessel operators will avoid transit in North Pacific right whale critical habitat. If this cannot be avoided, operators must exercise caution and reduce speed to 10 knots while in North Pacific right whale critical habitat.

ii. Vessels transiting through North Pacific right whale critical habitat must have PSOs sighting marine mammals. Vessel operators will maneuver to keep 875 yards away from any observed North Pacific right whale, while within their designated critical habitat, and avoid approaching whales head-on, consistent with vessel safety.

iii. Operators will maintain a ship log indicating the time and geographic coordinates at which vessels enter and exit NPRW critical habitat.

III. Vessels in Vicinity of Pacific Walruses and Polar Bears

a. Operators should take all reasonable precautions, such as reduce speed or change course heading, to maintain a minimum operational exclusion zone of 0.5 mile around groups of feeding walruses.

b. Except in an emergency, vessel operators would not approach within 0.5 mile of observed polar bears, within 0.5 mile of walrus observed on ice, or within 1 mile of walrus observed on land.

IV. Vessels in Vicinity of Seals

Vessels used as part of a BLM-authorized activity would be operated in a manner that minimizes disturbance to wildlife in the coastal area. Vessel operators would maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) when they have hauled out on land, unless doing so would endanger human life or violate safe boating practices.

V. Vessel Transit through Steller Sea Lion Critical Habitat/Near Major Rookeries and Haulouts

The vessel operator will not purposely approach within 3 nautical miles (nm; 5.5 km) of major Steller sea lion rookeries or haulouts where vessel safety requirements allow and/or where practicable. Vessels will remain 3 nm (5.5 km) from all Steller sea lion rookery sites listed in paragraph 50 CFR 224.103 (d)(1)(iii).

Post-lease activities may have additional mitigation imposed through conditions of approval of plans, permit conditions, or other mechanisms. As specific projects are proposed in this multi-stage oil and gas program, more precise information about the nature and extent of the activities – including the scale and location of activities and a description of the particular technologies to be employed – will be considered and evaluated in subsequent BLM reviews, step-down section 7 consultations, and other analyses (e.g., NEPA, MMPA). Through this multi-stage process, a dynamic analysis of the potential effects of oil and gas activities is ensured and additional mitigation measures and protections may be developed and required at any stage based on the specific details of the particular projects.

4. ACTION AREA

Under section 7 of the ESA the Action Area includes all areas in which listed species or designated critical habitat may be affected by the Federal action. In determining the effects of the action, and hence the Action Area, we consider the consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that result from the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

In this BO we define the Action Area based on information provided by the BLM to include all the areas that may be affected by activities described in the BLM's RFD. The Action Area includes the entire Program Area, which comprises all lands within the boundary of the area described by PL 115-97, including U.S. Fish and Wildlife managed lands and private lands subject to the BLM's oil and gas leasing authority. The Action Area also includes lands for which the BLM does not have direct management authority but upon which effects of the action may occur, including Native selected and interim conveyed lands, Native lands excluded from PL 115-97, and Air Force owned-lands (Figure 4.1). The Action Area also includes nearshore waters and sea ice adjacent to the Program Area and the MTR from Dutch Harbor, Alaska through the Bering, Chukchi, and Beaufort seas to the coast of the Arctic Refuge (Figure 4.2).

There are multiple geographic descriptors used in this document. These are defined as:

- Action Area – as described above, the Action Area includes the Program Area, private lands within the boundary of the Coastal Plain of Arctic Refuge, adjacent marine waters and sea ice that could be affected by activities in the Program Area, and the MTR through the Bering, Chukchi, and Beaufort seas to Dutch Harbor.

- Program Area – describes the lands subject to the BLM's oil and gas leasing authority.

- Arctic Coastal Plain – is a physiographic region comprising low-lying, relatively flat tundra adjacent to the north coast of Alaska and northern Canada.

- Coastal Plain of Arctic Refuge – is the portion of the Arctic National Wildlife Refuge subject to PL 115-97 and proposed for oil and gas leasing.

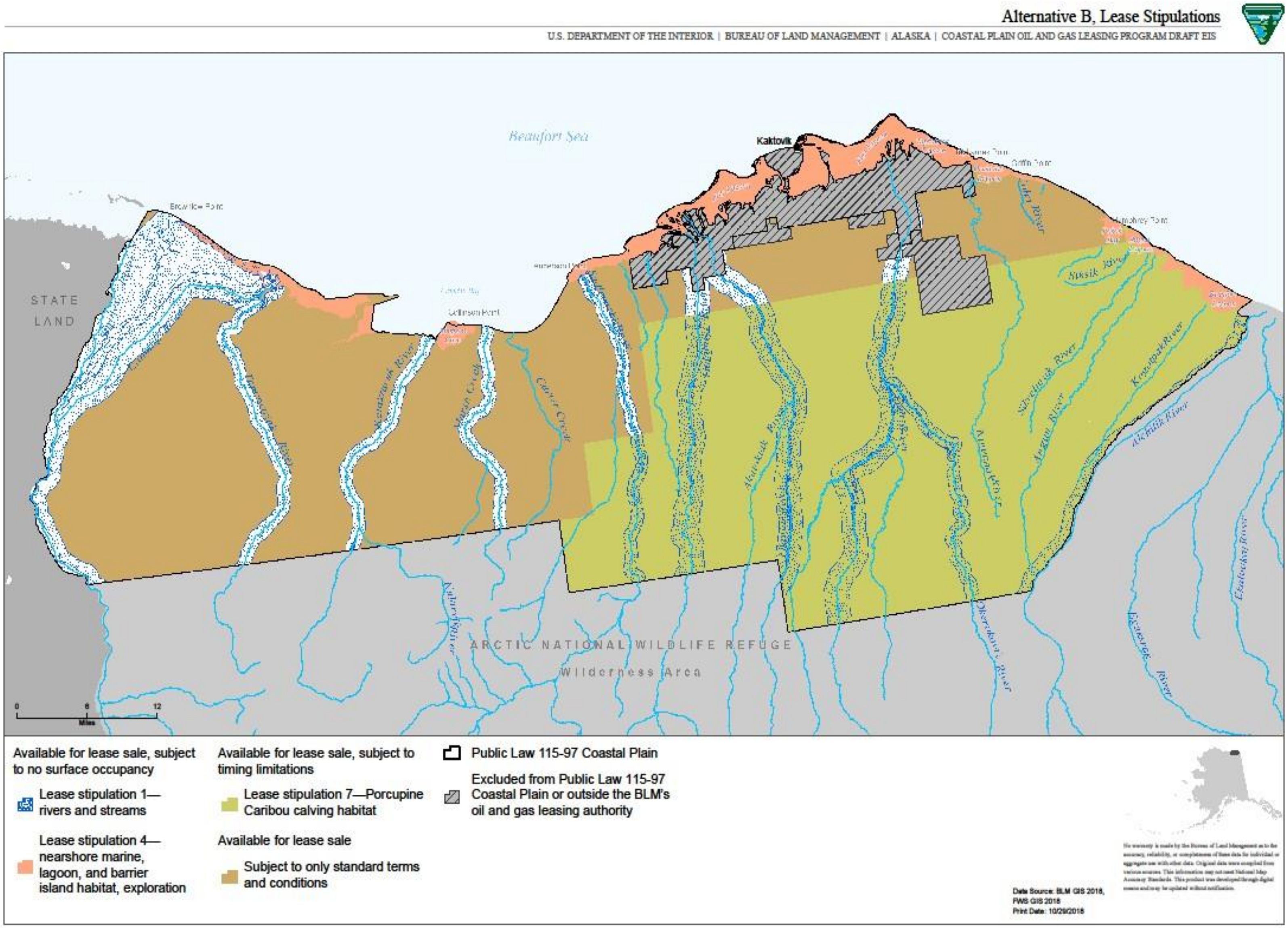

Figure 4.1. The proposed Lease Sale Action Area, the Coastal Plain of Arctic Refuge, and Lease Stipulations associated with the RFD, Alternative B (BLM 2018a).

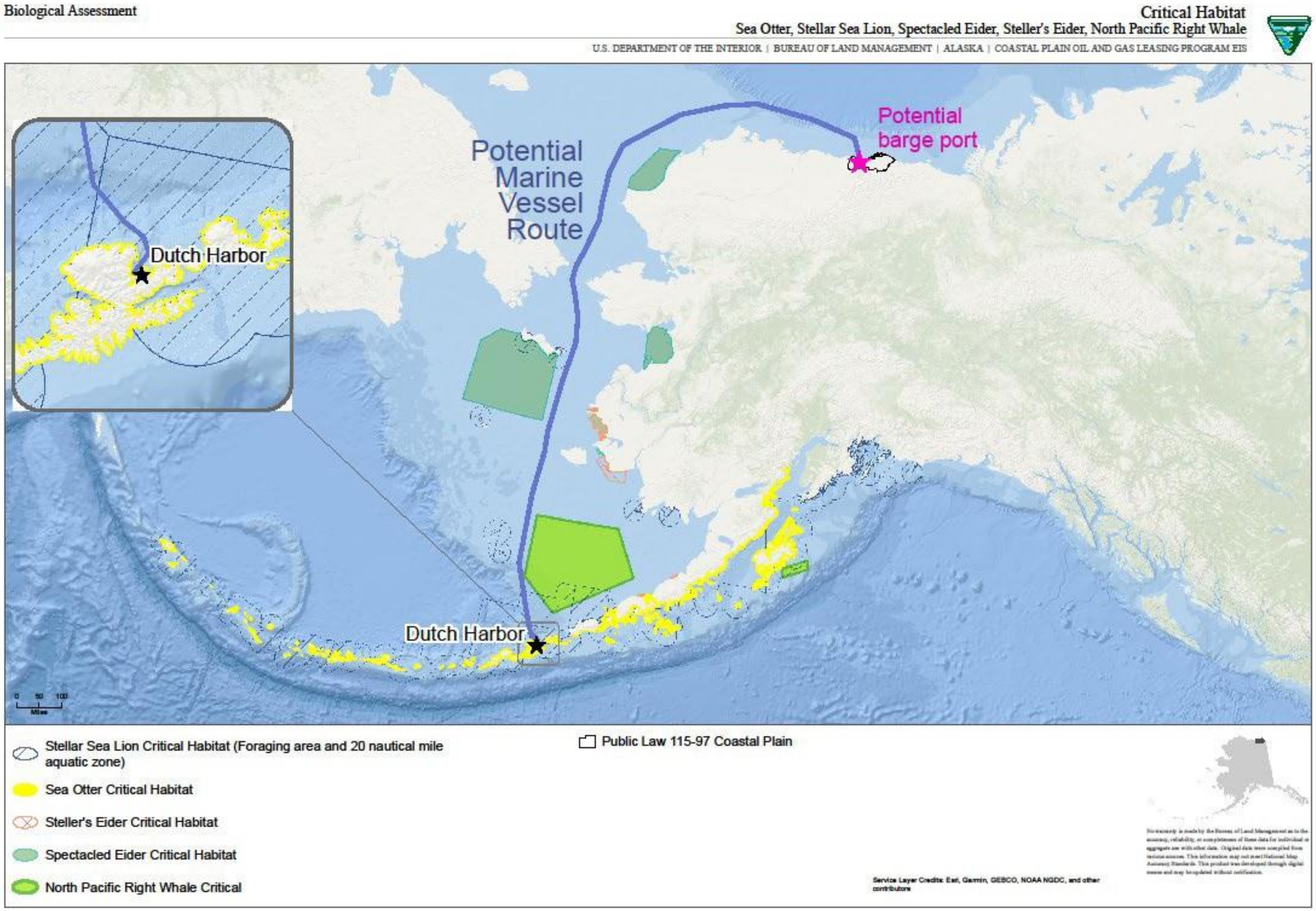

Figure 4.2. Hypothetical Marine Transit Route (MTR), from Dutch Harbor to proposed Coastal Plain of Arctic Refuge barge landing, associated with the proposed RFD (BLM 2018a).

5. EFFECT DETERMINATION FOR NORTHERN SEA OTTER AND NORTHERN SEA OTTER CRITICAL HABITAT

5.1 Northern sea otter

he Service listed the southwest Alaska distinct population segment (DPS) of the northern sea otter as threatened on August 9, 2005 (70 FR 46366). Barging operations associated with the development phase of the RFD may encounter and disturb listed sea otters when transiting in and out of Dutch Harbor in the vicinity of Unalaska Island *en route* to the Program Area.

However, sea otter density is relatively low in the vicinity of Dutch Harbor, and we expect sea lift barges would encounter very few individuals. We would also expect disturbance from barge traffic to be minor and temporary because 1) barges would move slowly through the vicinity of Dutch Harbor as they arrive and depart from the port, and 2) sea otters can respond to vessel presence or disturbance by moving away to a safe distance. Because disturbance to listed sea otters would be so minor that injury or death is not expected, we expect the effects of disturbance would be insignificant.

Listed sea otters could also be impacted by unintentional fuel spills during vessel re-fueling in Dutch Harbor. However, the BLM has indicated any spills that take place during refueling operations would likely be small in size, and be quickly contained and remediated (BLM 2019). Therefore, we anticipate impacts to listed sea otters from small refueling spills would be insignificant. Furthermore, because large spills (>500 bbl) are not anticipated from barging operations, impacts from large spills on listed sea otters would be discountable.

In summary, because effects of disturbance would be minor and temporary, and impacts from fuel spills would be insignificant and/or discountable, we expect effects of the proposed action on listed sea otters would be insignificant. Therefore, the Proposed Program is *not likely to adversely affect* the southwest Alaska DPS of the northern sea otter.

5.2 Northern sea otter critical habitat

The Service designated critical habitat for the southwest Alaska DPS of the northern sea otter on October 8, 2009 (74 FR 51988). Critical habitat occurs in nearshore marine waters around Unalaska Island (Unit 2) ranging from the mean high tide line seaward for a distance of 100 meters, or to a water depth of 20 meters. Barge traffic during the development phase of the RFD may enter designated critical habitat near Dutch Harbor and Unalaska Island.

Designated critical habitat for sea otters could be impacted by unintentional fuel spills during vessel re-fueling in Dutch Harbor. However, the BLM has indicated any spills that take place during refueling operations would likely be small in size, and be quickly contained and remediated (BLM 2019). Therefore we anticipate impacts to sea otter critical habitat from small refueling spills would be insignificant. Furthermore, because large spills (>500 bbl) are not anticipated from barging operations impacts from large spills on sea otter critical habitat would be discountable.

Because 1) overlap between barge traffic and designated sea otter critical habitat would be limited to the vicinity of Dutch Harbor and Unalaska Island, which represents a very small proportion of designated sea otter critical habitat, 2) vessel presence in critical habitat would be temporary as barges pass through the area, and 3) spills from re-fueling would be expected to be small, and contained and remediated quickly; action-specific impacts from the proposed vessel traffic are expected to be insignificant. Therefore, the Proposed Program is *not likely to adversely affect* designated sea otter critical habitat.

6. STATUS OF THE SPECIES

his section presents biological and ecological information relevant to the BO. Appropriate information on species' life history, habitat and distribution, and other factors necessary for their survival is included for analysis in later sections.

6.1 Spectacled eider

Status and Distribution

The spectacled eider, a large, benthivorous sea duck (Figure 6.1A), was listed as threatened throughout its range on May 10, 1993 (USFWS 1993) based on indications of steep declines in the two Alaska-breeding populations. There are three primary spectacled eider populations, corresponding to breeding grounds: Alaska's North Slope or Arctic Coastal Plain (ACP), the Yukon–Kuskokwim Delta (YK- Delta), and northern Russia. The YK-Delta population of spectacled eiders declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, Alaska (R. Suydam, pers. comm. in USFWS 1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available.

Spectacled eiders molt in several discrete areas (Figure 6.1B) during late summer and fall, with birds from different populations and genders apparently favoring different molting areas (Petersen et al. 1999). All three spectacled eider populations overwinter in openings in pack ice of the central Bering Sea, south of St. Lawrence Island (Petersen et al. 1999; Figure 6.1B), where they remain until March–April (Lovvorn et al. 2003).

Breeding

In Alaska, spectacled eiders breed primarily on the ACP of the North Slope and the YK-Delta. On the ACP, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 15 miles inland from its mouth, with breeding density varying across the ACP (Figure 6.2). Although spectacled eiders historically occurred throughout the coastal zone of the YK-Delta, they currently breed primarily in the central coast zone within about 9 miles of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996). However, sightings on the YK-Delta have also occurred both north and south of this area during the breeding season (R. Platte, USFWS, pers. comm. 1997).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Anderson and Cooper 1994, Smith et al. 1994, Anderson et al. 1995, Bart and Earnst 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). Spectacled eider clutch size near Utqiaġvik has averaged 3.2–4.1, with clutches of up to eight eggs reported (Quakenbush et al. 1995; Safine 2011). Incubation lasts 20–25 days (Kondratev and Zadorina 1992; Harwood and Moran 1993; Moran and Harwood 1994; Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992).

On the breeding grounds, spectacled eiders feed on mollusks, insect larvae (craneflies, caddisflies, and midges), small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Ducklings fledge approximately 50 days after hatch, when females with broods move from freshwater to marine habitat prior to fall migration.

Survivorship
Nest success is highly variable and thought to be primarily influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), red (*Vulpes vulpes*) and arctic foxes (*Alopex lagopus*). In arctic Russia, apparent nest success was estimated to be < 2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992; Anderson et al. 1998). On Kigigak Island in the YK-Delta, nest survival probability ranged from 6–92% from 1992–2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season. Bowman et al. (2002) also reported high variation in nest success (20–95%) of spectacled eiders on the YK-Delta, depending on year and location.

(A)

(B)

Figure 6.1. (A) Male and female spectacled eiders in breeding plumage. (B) Distribution of spectacled eiders. Molting areas (green) are used July–October. Wintering areas (yellow) are used October–April. The full extent of molting and wintering areas is incompletely documented and may extend beyond the boundaries shown.

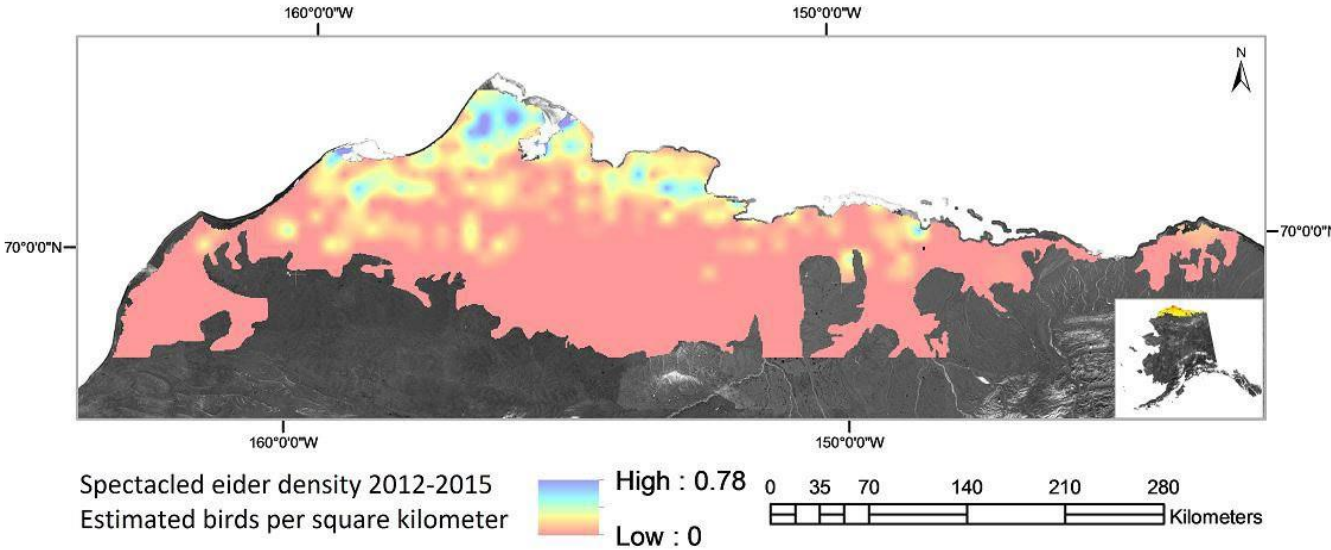

Figure 6.2. Density distribution of spectacled eiders observed on aerial transects of wetland tundra on the North Slope of Alaska during breeding pair surveys in June, 2012–2015 (USFWS 2015).

Available data indicate egg hatchability is high for spectacled eiders nesting on the ACP, in arctic Russia, and at inland sites on the YK-Delta, but considerably lower in the coastal region of the YK-Delta. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Recruitment rate (the percentage of young eiders that hatch, fledge, and survive to sexual maturity) of spectacled eiders is poorly known (USFWS 1999) because there is limited data on juvenile survival. In the coastal region of the YK-Delta, duckling survival to 30 days averaged 34%, with 74% of mortality occurring in the first 10 days, while survival of adult females during the first 30 days post hatch was 93% (Flint et al. 1997).

Fall migration and molting

Spectacled eiders spend the 8–10 month non-breeding season at sea. Satellite telemetry and aerial surveys led to the identification of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995, 1999) and Larned et al. (1995). Results of more recent satellite telemetry research (2008–2011) are consistent with earlier studies (Matt Sexson, USGS, pers. comm.). Phenology, spring migration and breeding, including arrival, nest initiation, hatch, and fledging, is 3–4 weeks earlier in western Alaska (YK-Delta) than northern Alaska (ACP); however, phenology of fall migration is similar between areas. Individuals depart breeding areas July–September, depending on breeding status and success, and molt in September–October (Matt Sexson, USGS, pers. comm.).

Males generally depart breeding areas on the ACP when females begin incubation in late June (Anderson and Cooper 1994; Bart and Earnst 2005). Use of the Beaufort Sea by departing males is variable. Some appear to move directly to the Chukchi Sea over land, while the majority move rapidly (average travel of 1.75 days) over nearshore waters from breeding grounds to the Chukchi Sea (TERA 2002). Of 14 males implanted with satellite transmitters, only four spent an extended period of time (11–30 days) in the Beaufort Sea (TERA 2002). Males appeared to prefer areas near large river deltas such as the Colville River where open water is more prevalent in early summer when much of the Beaufort Sea is still frozen. Most adult males marked with satellite transmitters in northern and western Alaska in a recent satellite telemetry study migrated to northern Russia to molt (USGS, unpublished data). Results from this study also suggest that male eiders likely follow coast lines but also migrate straight across the northern Bering and Chukchi seas *en route* to northern Russia (Matt Sexson, USGS, pers. comm.).

Females generally depart the breeding grounds later, when more of the Beaufort Sea is ice-free, allowing more extensive use of the area. Females spent an average of two weeks in the Beaufort Sea (range 6-30 days) with the western Beaufort Sea the most heavily used (TERA 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than males (Petersen et al. 1999). The greater use of the Beaufort Sea and offshore areas by females was attributed to the greater availability of open water when females depart the area (Petersen et al. 1999; TERA 2002). Recent telemetry data indicate that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid, 2 weeks, compared to 2–3 months spent in the Chukchi Sea (Matt Sexson, USGS, pers. comm.).

Spectacled eiders use specific molting areas from July to late October/early November. Larned et al. (1995) and Petersen et al. (1999) found spectacled eiders show strong preference for specific molting locations, and concluded that spectacled eiders molt in four discrete areas (Table 6.1). Females generally used molting areas nearest their breeding grounds. All marked females from the YK-Delta molted in nearby Norton Sound, while females from the North Slope molted in Ledyard Bay, along the Russian coast, and near St. Lawrence Island. Males did not show strong molting site fidelity; males from all three breeding areas molted in Ledyard Bay, Mechigmenskiy Bay, and the Indigirka/Kolyma River Delta. Males reached molting areas first, beginning in late June, and remained through mid-October. Non-breeding females, and those that nested but failed, arrived at molting areas in late July, while successfully-breeding females and young of the year reached molting areas in late August through late September and remained through October. Fledged juveniles marked on the Colville River Delta usually staged in the Beaufort Sea near the delta for 2–3 weeks before migrating to the Chukchi Sea.

Table 6.1. Important staging and molting areas for female and male spectacled eiders from each breeding population.

Population and Sex	Known Major Staging/Molting Areas
Arctic Russia Males	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
	Ledyard Bay
Arctic Russia Females	unknown
North Slope Males	Ledyard Bay
	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
North Slope Females	Ledyard Bay
	Mechigmenskiy Bay
	West of St. Lawrence Island
YK-Delta Males	Mechigmenskiy Bay Northeastern Norton Sound
YK-Delta Females	Northeastern Norton Sound

Avian molt is energetically demanding, especially for species such as spectacled eiders that complete molt in a few weeks. Molting birds require adequate food resources, and apparently the benthic community of Ledyard Bay (Feder et al. 1989, 1994a, 1994b) provides this for spectacled eiders. Large concentrations of spectacled eiders molt in Ledyard Bay using this food resource; aerial surveys on 4 days in different years counted 200 to 33,192 molting spectacled eiders in Ledyard Bay (Larned et al. 1995; Petersen et al. 1999).

Wintering

Spectacled eiders generally depart molting areas in late October/early November (Sexson et al. 2014; Sexson 2015), migrating offshore in the Chukchi and Bering seas to a single wintering area in pack-ice lead complexes south/southwest of St. Lawrence Island (Figure 6.1B). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 230 feet to eat bivalves, other mollusks, and crustaceans (Cottam 1939; Petersen et al. 1998; Lovvorn et al. 2003; Petersen and Douglas 2004).

Spring migration

Recent information indicates spectacled eiders likely make extensive use of the eastern Chukchi Sea spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring observations in the eastern Chukchi Sea have documented tens to several hundred common eiders (*Somateria mollissima*) and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, Southern Illinois University, pers. comm.). Woodby and Divoky (1982) documented large numbers of king and common eiders using the eastern Chukchi lead system, advancing in pulses during days of favorable following winds, and concluded that an open lead is probably requisite for spring eider passage in this region. Satellite telemetry data collected by the USGS Alaska Science Center (Figure 6.3; Sexson et al. 2014) suggests that spectacled eiders also use the spring lead system during spring migration.

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most larger sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate eggs while living primarily off body reserves (Korschgen 1977; Drent and Daan 1980; Parker and Holm 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Raveling 1979; Coulson 1984; Parker and Holm 1990). Body reserves must be maintained from winter or acquired during the 4-8 weeks (Lovvorn et al. 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during migration through the Chukchi Sea (including Ledyard Bay). Common eider female body mass increased 20% during the 4-6 weeks prior to egg laying (Gorman and Milne 1971; Milne 1976; Korschgen 1977; Parker and Holm 1990). For spectacled eiders, average female body weight in late March in the Bering Sea was 1,550 ± 35 g (n = 12), and slightly (but not significantly) more upon arrival at breeding sites (1,623 ± 46 g, n = 11; Lovvorn et al. 2003), suggesting that spectacled eiders maintain or enhance their physiological condition during spring staging.

Abundance and trends

The most recent rangewide estimate of abundance of spectacled eiders was 369,122 (364,190–374,054 90% CI), obtained by aerial surveys of the known wintering area in the Bering Sea in late winter 2010 (Larned et al. 2012). Comparison of point estimates between 1997 and 2010 indicate an average of 353,051 spectacled eiders (344,147–361,956 90% CI) in the global population over that 14-year period (Larned et al. 2012).

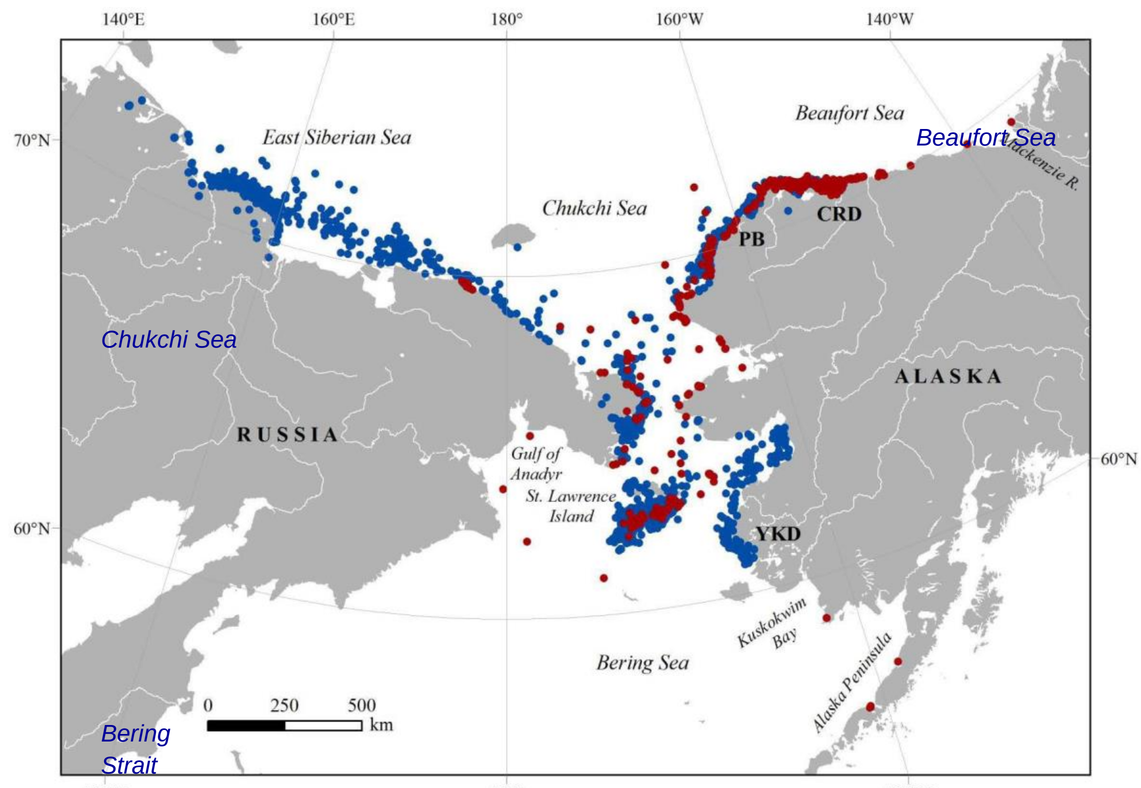

Figure 6.3. Satellite telemetry locations received from 89 adult (blue points, n = 6,813) and 27 juvenile (red points, n = 371) spectacled eiders between 30 May 2008 and 9 August 2012. Satellite Transmitters were implanted in spectacled eiders in the YK-Delta in 2008, at Peard Bay (PB) in 2009, and in the Colville River Delta (CRD) in 2009–2011 (Sexson et al. 2014).

Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 to 1991 in the Prudhoe Bay area, but evidence of a significant decline elsewhere on the North Slope, or since 1991 is lacking. Since 1992, the Service has conducted annual aerial surveys for breeding spectacled eiders on the ACP. The 2010 population index based on these aerial surveys was 6,286 birds (95% CI, 4,877–7,695; unadjusted for detection probability), which is 4% lower than the 18-year mean (Larned et al. 2011). In 2010, the index growth rate was significantly negative for both the long-term (0.987; 95% CI, 0.974–0.999) and most recent 10 years (0.974; 95% CI, 0.950–0.999; Larned et al. 2011). Stehn et al. (2006) developed a North Slope-breeding population estimate of 12,916 (95% CI, 10,942–14,890) based on the 2002–2006 ACP aerial index for spectacled eiders and relationships between ground and aerial surveys on the YK-Delta. If the same methods are applied to the 2003–2012 ACP aerial index, the resulting adjusted population estimate for North Slope-breeding spectacled eiders is 14,814 (13,501–16,128, 90% CI; Stehn et al. 2013).

The YK-Delta spectacled eider population is thought to have declined by about 96% from the 1970s to 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the YK-Delta was corroborated by Ely et al. (1994), who found a 79% decline in eider nesting near the Kashunuk River between 1969 and 1992. Aerial and ground survey data indicated that spectacled eiders declined 9–14% per year from 1985–1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the YK-Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the YK-Delta in average to good years (Dau and Kistchinski 1977).

Fischer and Stehn (2013) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the YK-Delta in 2012 and evaluate long-term trends in the YK-Delta breeding population from 1985 to 2012. In a given year, the estimated number of nests reflects the minimum number of breeding pairs in the population and does not include non-nesting individuals or nests that were destroyed or abandoned (Fischer and Stehn 2013). The total number of spectacled eider nests on the YK-Delta in 2012 was estimated at 8,062 (SE 1110). The average population growth rate based on these surveys was 1.058 (90% CI = 1.005-1.113) in 2003–2012 and 0.999 (90% CI = 0.986-1.012) in 1985–2012 (Fischer and Stehn 2013). Log-linear regression based solely on the long-term YK-Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI = 1.046–1.100) in 2001–2010 and 1.070 (90% CI = 1.058–1.081) in 1988–2010 (Platte and Stehn 2011).

Spectacled eider recovery criteria

The Spectacled Eider Recovery Plan (USFWS 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the ESA is no longer required. Although the cause or causes of the spectacled eider population decline is/are not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the YK-Delta (Franson et al. 1995; Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (YK-Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

6.2 Spectacled Eider Critical Habitat

On February 6, 2001, the Service designated critical habitat for the spectacled eider. Areas designated include portions of the YK-Delta, Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Mathew Islands. Only the Ledyard Bay Critical Habitat Unit (LBCHU) is within the Action Area as it is within the area of the MTR.

The LBCHU was designated to protect molting spectacled eiders. It is used by large numbers of eiders with 33,192 counted by aerial survey in September 1995 (Larned et al. 1995). In particular satellite telemetry data indicates that females who breed on the North Slope primarily use this area for molting (Peterson et al. 1995). We identified marine waters >5 m and ≤ 25 m at mean low water, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community as the physical or biological features essential to the conservation of spectacled eiders which are provided by the LBCHU.

6.3 Steller's Eider

The Steller's eider is a small sea duck with circumpolar distribution and the sole member of the genus *Polysticta*. Males are in breeding plumage (Figure 6.4) from early winter through mid-summer. Females are dark mottled brown with a white-bordered blue wing speculum (Figure 6.4). Juveniles are dark mottled brown until fall of their second year, when they acquire breeding plumage.

Figure 6.4. Male and female Steller's eiders in breeding plumage.

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further subdivided into the Russia-breeding and Alaska-breeding populations. The Alaska-breeding population of Steller's eiders was listed as threatened on July 11, 1997 based on:

- Substantial contraction of the species' breeding range on the ACP and YK-Delta;
    - Steller's eiders on the North Slope historically occurred east to the Canada border (Brooks 1915), but have not been observed on the eastern North Slope in recent decades (USFWS 2002);
- Reduced numbers breeding in Alaska; and,
- Resulting vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997).

In Alaska, Steller's eiders breed almost exclusively on the ACP and winter, along with the majority of the Russia-breeding population, in southwest Alaska (Figure 6.5). Periodic non-breeding of Steller's eiders, coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al. 2004). In 2001, the Service designated 2,830 mi2 (7,330 km2) of critical habitat for the Alaska-breeding population of Steller's eiders, including historical breeding areas on the YK-Delta, molting and staging areas in the Kuskokwim Shoals and Seal Islands, molting wintering, and staging areas at Nelson Lagoon, and Izembek Lagoon (USFWS 2001). No critical habitat for Steller's eiders has been designated on the ACP.

Life History

Breeding – Steller's eiders arrive in small flocks of breeding pairs on the ACP in early June. Nesting on the ACP is concentrated in tundra wetlands near Utqiaġvik (formerly Barrow), AK (Figure 6.6) and occurs at lower densities elsewhere on the ACP from Wainwright east to the Sagavanirktok River (Quakenbush et al. 2002). Long-term studies of Steller's eider breeding ecology near Utqiaġvik indicate periodic non-breeding by the entire local population. From 1991-2010, Steller's eiders nests were detected in 12 of 20 years (Safine 2011). Periodic non-breeding by Steller's eiders near Utqiaġvik seems to correspond to fluctuations in lemming populations and risk of nest predation (Quakenbush et al. 2004). During years of peak abundance, lemmings are a primary food source for predators including jaegers, owls, and foxes (Pitelka et al. 1955a; Pitelka et al. 1955b; MacLean et al. 1974; Larter 1998; Quakenbush et al. 2004). It is hypothesized that Steller's eiders and other ground-nesting birds increase reproductive effort during lemming peaks because predators preferentially select (prey-switch) for hyper-abundant lemmings and nests are less likely to be depredated (Roselaar 1979; Summers 1986; Dhondt 1987; Quakenbush et al. 2004). Furthermore, during high lemming abundance, Steller's eider nest survival (the probability of at least one duckling hatching) has been reported as a function of distance from nests of jaegers and snowy owls (Quakenbush et al. 2004). These avian predators aggressively defend their nests against other predators and this defense likely indirectly imparts protection to Steller's eiders nesting nearby.

Steller's eiders initiate nesting in the first half of June and nests are commonly located on the rims of polygons and troughs (Quakenbush et al. 2000, 2004). Mean clutch size at Utqiaġvik was 5.4 ± 1.6 SD (range = 1–8) over 5 nesting years between 1992 and 1999 (Quakenbush et al. 2004). Breeding males depart following onset of incubation by the female. Nest survival is affected by predation levels, and averaged 0.23 (±0.09, standard error [SE]) from 1991–2004 before fox control was implemented near Utqiaġvik and 0.47 (±0.08 SE) from 2005–2012 during years with fox control (USFWS, unpublished data). Steller's eider nest failure has been attributed to depredation by jaegers (*Stercorarius* spp.), common ravens (*Corvus corax*), arctic fox (*Alopex lagopus*), glaucous gulls (*Larus hyperboreus*), and in at least one instance, polar bears (Quakenbush et al. 1995; Rojek 2008; Safine 2011; Safine 2012).

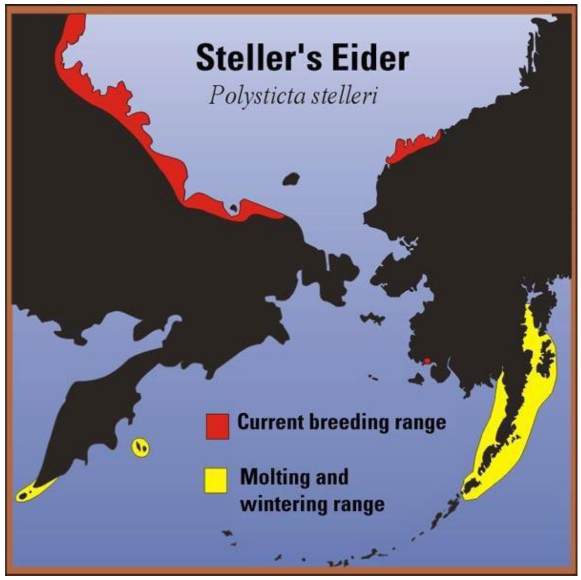

Figure 6.5. Steller's eider distribution in the Bering, Chukchi, and Beaufort seas.

Hatching occurs from mid-July through early August, after which hens move their broods to adjacent ponds with emergent vegetation dominated by *Carex* spp. and *Arctophila fulva* (Quakenbush et al. 2000; Rojek 2006, 2007, 2008). In these brood-rearing ponds, hens with ducklings feed on aquatic insect larvae and freshwater crustaceans. In general, broods remain within 0.7 km of their nests (Quakenbush et al. 2004); although, movements of up to 3.5 km from nests have been documented (Rojek 2006 and 2007). Large distance movements from hatch sites may be a response to drying of wetlands that would normally have been used for brood-rearing (Rojek 2006). Fledging occurs 32–37 days post hatch (Obritschkewitsch et al. 2001; Quakenbush et al. 2004; Rojek 2006, 2007).

Information on breeding site fidelity of Steller's eiders is limited. However, ongoing research at Utqiaġvik has documented some cases of site fidelity in nesting Steller's eiders. Since the mid-1990s, eight banded birds that nested near Utqiaġvik were recaptured in subsequent years again nesting near Utqiaġvik. Time between capture events ranged from 1 to 12 years and distance between nests ranged from 0.1 to 6.3 km (USFWS, unpublished data).

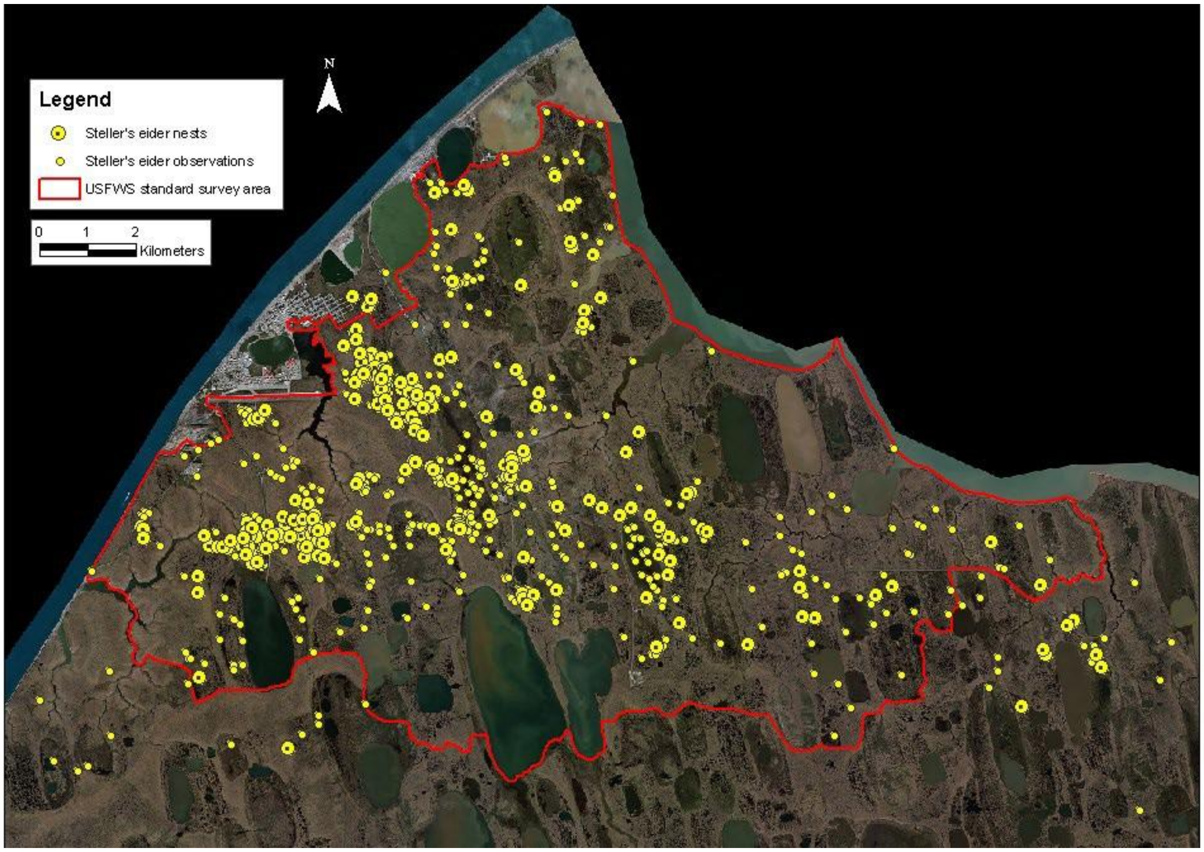

Figure 6.6. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010). The red border represents the standard annual survey area. This survey is expanded beyond the standard area in some years.

Localized movements – Timing of departure from the breeding grounds near Utqiaġvik differs between sexes and between breeding and non-breeding years. In breeding years, male Steller's eiders typically leave the breeding grounds in late June to early July after females begin incubating (Obritschkewitsch et al. 2001, Quakenbush et al. 1995, Rojek 2006 and 2007). Females with fledged broods depart the breeding grounds in late August and mid-September to rest and forage in freshwater and marine habitat near the Barrow spit prior to fall migration along the Chukchi coast. Females with broods are often observed near the channel that connects North Salt Lagoon and Elson Lagoon (J. Bacon, NSBDWM, pers. comm.). In 2008, 10–30 Steller's eider adult females and juveniles were observed staging daily in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea from late August to mid-September (USFWS, unpublished data).

Before fall migration in breeding and non-breeding years, some Steller's eiders rest and forage in in coastal waters near Utqiaġvik including Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the vicinity of Pigniq (Duck Camp; Figure 6.7). In breeding years, these flocks are primarily composed of males that remain in the area until the second week of July, while in non-breeding years, flocks are composed of both sexes and depart earlier than in nesting years (J. Bacon, North Slope Borough Department of Wildlife Management [NSBDWM], pers. comm.).

Safine (2012) investigated post-hatch movements of 10 Steller's eider hens with VHF transmitters in 2011. Most (8 of 10) females successfully reared broods to fledging. From late August through early September, females and fledged juveniles were observed in nearshore waters of the Chukchi and Beaufort seas from Point Barrow south along the coast approximately 18 km. During this period, marked Steller's eiders and broods frequented areas traditionally used for subsistence waterfowl hunting (e.g., Duck Camp; Figure 6.7).

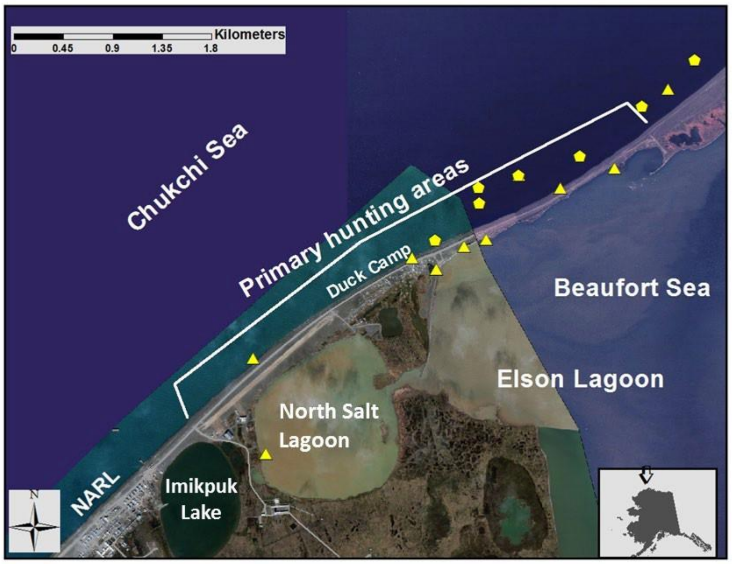

Figure 6.7. Some post-breeding and pre-migration staging areas for Steller's eiders near Utqiaġvik, Alaska. Locations of Steller's eider hens with successfully-fledged (triangles) and failed broods (pentagons) from mid-August to early September 2011.

Wing molt – Following departure from the breeding grounds, Steller's eiders migrate to southwest Alaska where they undergo complete flightless molt for about 3 weeks. Preferred molting areas are shallow with extensive eelgrass (*Zostera marina*) beds and intertidal mud and sand flats where Steller's eiders forage on bivalve mollusks and amphipods (Petersen 1980, 1981; Metzner 1993).

The Russia- and Alaska-breeding populations both molt in southwest Alaska, and banding studies found at least some individuals had a high degree of molting site fidelity in subsequent years (Flint et al. 2000). Primary molting areas include the north side of the Alaska Peninsula (Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands; Gill et al. 1981; Petersen 1981; Metzner 1993) as well as the Kuskoskwim Shoals in northern Kuskokwim Bay (Martin et al. 2015). Larned (2005) also reported > 2,000 eiders molting in lower Cook Inlet near the Douglas River Delta, and smaller numbers of molting Steller's have been reported around islands in the

Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (e.g., Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991).

Winter distribution – After molt, many Pacific-wintering Steller's eiders disperse throughout the Aleutian Islands, Alaskan Peninsula, and western Gulf of Alaska including Kodiak Island and lower Cook Inlet (Figure 6.8; Larned 2000a; Martin et al. 2015), although thousands may remain in molting lagoons unless freezing conditions force departure (USFWS 2002). The Service estimates the Alaska-breeding population comprises only ~ 1% of the Pacific-wintering population of Steller's eiders. Wintering Steller's eiders usually occur in shallow waters (< 10 m deep), within 400 m of shore or in shallow waters further offshore (USFWS 2002). However, Martin et al. (2015) reported substantial use of habitats > 10 m deep during mid-winter, although this use may reflect nocturnal rest periods or shifts in availability of food resources (Martin et al. 2015).

Spring migration – During spring migration, thousands of Steller's eiders stage in estuaries along the north coast of the Alaska Peninsula and, in particular, at Kuskokwim Shoals in late May (Figure 6.8; Larned 2007; Martin et al. 2015). Larned (1998) concluded that Steller's eiders show strong site fidelity to specific areas[5] during migration, where they congregate in large numbers to feed before continuing northward.

[5] Several areas receive consistent use by Steller's eiders during spring migration, including Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port Heiden, Cinder River State Critical Habitat Area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island (Larned 1998, Larned 2000a, Larned 2000b, Larned et al. 1993).

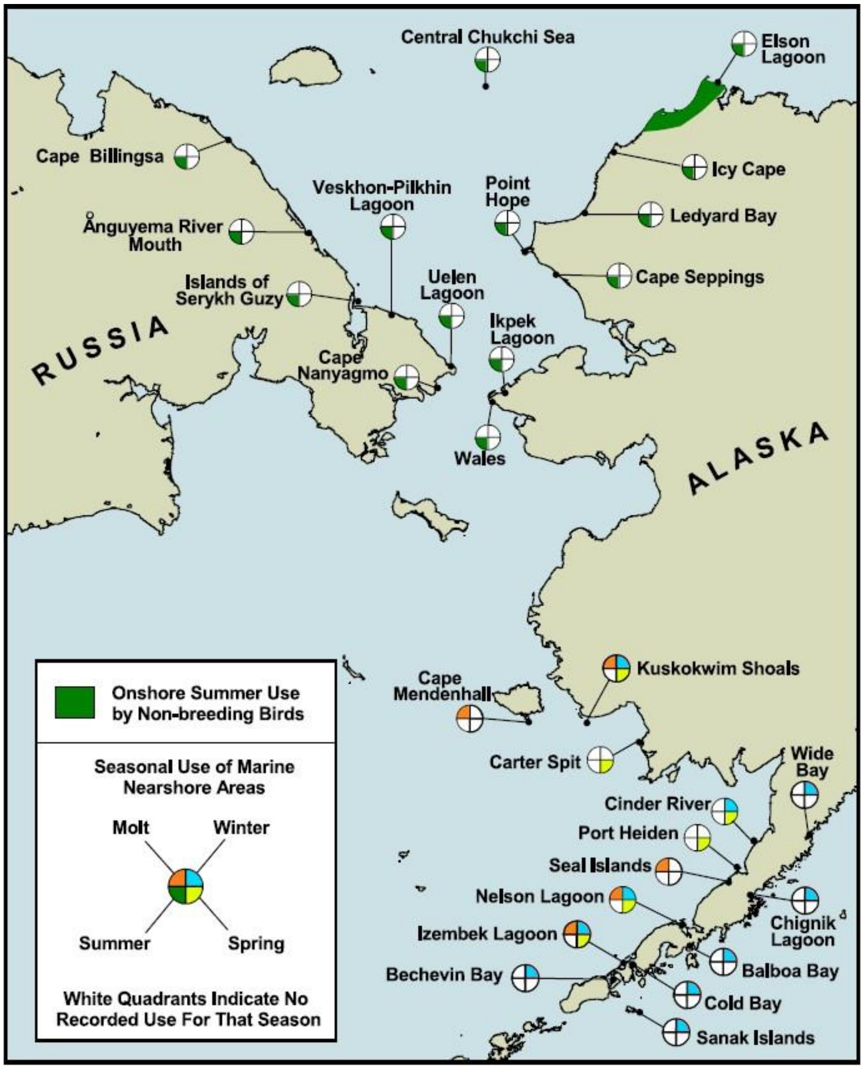

Figure 6.8. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on locations of 13 birds implanted with satellite transmitters in Utqiaġvik, Alaska, during June 2000 and June 2001. Marked locations include all those at which a bird remained for at least three days. Onshore summer use areas comprise locations of birds that departed Utqiaġvik, apparently without attempting to breed in 2001 (USFWS 2002).

Spring migration usually includes movements along the coast, although some Steller's eiders may make straight line crossings of water bodies such as Bristol Bay (W. Larned, USFWS, pers. comm. 2000). Despite numerous aerial surveys, Steller's eiders have not been observed during migratory flights (W. Larned, USFWS, pers. comm. 2000). Steller's eiders likely use spring leads for feeding and resting as they move northward, although there is little information on distribution or habitat use after departure from spring staging areas.

Migration patterns relative to breeding origin – Information is limited on migratory movements of Steller's eiders in relation to breeding origin, and it remains unclear where the Russia- and Alaska-breeding populations converge and diverge during their molt and spring migrations.

Martin et al. (2015) attached satellite transmitters to 14 Steller's eiders near Utqiaġvik in 2000 and 2001. Despite the limited sample, there was disproportionately high use of Kuskokwim Shoals by Alaska-breeding Steller's eiders during wing molt compared to the Pacific population as a whole. However, Martin et al. (2015) did not find Alaska-breeding Steller's eiders to preferentially use specific wintering areas. A later study marked Steller's eiders wintering near Kodiak Island, Alaska and followed birds through the subsequent spring (n = 24) and fall molt (n = 16) migrations from 2004–2006 (Rosenberg et al. 2011). Most birds marked near Kodiak Island migrated to eastern arctic Russia prior to the nesting period and none were relocated on land or in nearshore waters north of the Yukon River Delta in Alaska (Rosenberg et al. 2011).

Alaska-breeding population abundance and trends – Stehn and Platte (2009) evaluated Steller's eider population and trends from multiple aerial surveys on the ACP:

- USFWS ACP survey
    - 1989–2006 (Mallek et al. 2007)
    - 2007–2008 (new ACP survey design; Larned et al. 2008, 2009)
- USFWS North Slope eider (NSE) survey
    - 1992–2006 (Larned et al. 2009)
    - 2007–2008 (NSE strata of new ACP survey; Larned et al. 2008, 2009)
    - Barrow Triangle (ABR) survey, 1999–2014 (ABR, Inc.; Obritschkewitsch and Ritchie 2015)

In 2007, the ACP and NSE surveys were combined under a single ACP survey design. Previously, surveys differed in spatial extent, timing, sampling intensity, and duration, and consequently, produced different estimates of population size and trend for Steller's eiders. These estimates, including results from previous analyses of the ACP and NSE survey data (Mallek et al. 2007; Larned et al. 2009), are summarized in Table 4.2. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure 6.9).

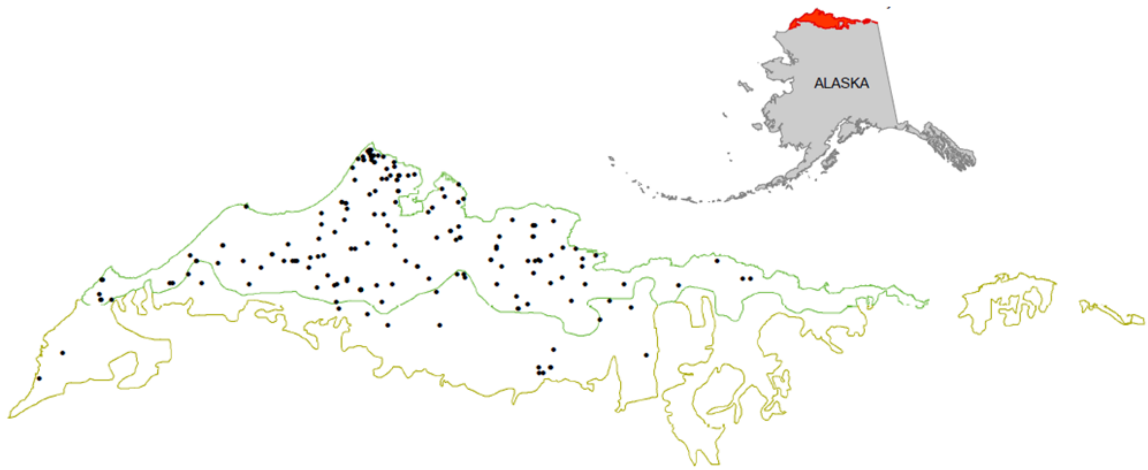

Figure 6.9. All Steller's eider sightings from the Arctic Coastal Plain (ACP) survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 km^2); the NSE includes only the northern portion outlined in green (30,465 km^2; modified from Stehn and Platte 2009).

Following assessment of potential biases inherent in both surveys, Stehn and Platte (2009) identified a subset of the NSE survey data (1993–2008) that were determined to be "least confounded by changes in survey timing and observers." Based on this subset, the average population index[6] for Steller's eiders on the ACP was 173 (90% CI 88–258) with an estimated growth rate of 1.011 (90% CI 0.857–1.193). Average population size of Steller's eiders breeding on the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009) assuming a detection probability of 30%[7]. Currently, this analysis provides the best available estimate of the Alaska-breeding Steller's eider population size and growth rate for the ACP. Note that these estimates are based on relatively few actual observations of Steller's eiders with none detected in some years.

[6] Geographically extrapolated total Steller's eiders derived from NSE survey counts.
[7] Detection probability of 30% with a visibility correction factor of 3.33 was selected based on evaluation of estimates for similar species and habitats (Stehn and Platte 2009).

The annual Barrow Triangle (ABR) survey provides more intensive coverage (50%, 1999–2004; 25–50%, 2005–2014) of the northern portion of the ACP. This survey has been conducted since 1999 over a 2,757 km^2 area south of Utqiaġvik (Figure 6.10) to compliment ground surveys closer to Utqiaġvik. Estimated Steller's eider density for the ABR survey area ranges from <0.01–0.03 birds/km^2 in non-nesting years to 0.03–0.08 birds/km^2 in nesting years. The estimated average population index for Steller's eiders within the Barrow Triangle was 99.6 (90% CI 55.5–143.7; Stehn and Platte 2009) with an estimated growth rate of 0.934 (90% CI 0.686–1.272). If we assume the same 30% detection probability applied to NSE estimates, average population size of Steller's eiders breeding in the Barrow Triangle area would be 332 (185–479, 90% CI).

Breeding population near Utqiaġvik, Alaska – The tundra surrounding Utqiaġvik supports the only significant concentration of Steller's eiders nesting in North America. Standardized ground surveys for eiders have been conducted near Utqiaġvik since 1999 (Figure 6.6; Rojek 2008). Counts of males are the most reliable indicator of Steller's eider presence because females are cryptic and often go undetected in counts. The greatest concentrations of Steller's eiders observed during Utqiaġvik ground surveys occurred in 1999 and 2008 with 135 and 114 males respectively (Table 6.2; Safine 2015). Total nests found (both viable[8] and post-failure) ranged from 0–78 between 1991 and 2014, while the number of viable nests ranged from 0–27. Steller's eider nests were found in 16 of 24 years (67%) between 1991 and 2014 (Safine 2015).

Table 6.2. Steller's eider males, nests, and pair densities recorded during ground-based and aerial surveys conducted near Utqiaġvik, Alaska 1999–2012 (modified from Safine 2015).

	Overall ground-based survey area			Standard Ground-based Survey Area[a]		Aerial survey of Barrow Triangle		
Year	Area (km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)[b]	Nests found near Utqiaġvik
1999	172	135	0.78	132	0.98	56	0.04	36
2000	136	58	0.43	58	0.43	55	0.04	23
2001	178	22	0.12	22	0.16	22	0.02	0
2002	192	1	<0.01	0	0	2	<0.01	0
2003	192	10	0.05	9	0.07	4	<0.01	0
2004	192	10	0.05	9	0.07	6	<0.01	0
2005	192	91	0.47	84	0.62	31	0.02	21
2006	191	61	0.32	54	0.40	24	0.02	16
2007	136	12	0.09	12	0.09	12	0.02	12
2008	166	114	0.69	105	0.78	24	0.02	28
2009	170	6	0.04	6	0.04	0	0	0
2010	176	18	0.10	17	0.13	4	0.01	2
2011	180	69	0.38	59	0.44	10	0.01	27
2012	176	61	0.35	55	0.41	37	0.03	19
2013	180	192	1.07	93	0.69	27	0.04	4
2014	170	137	0.81	119	0.89	30	0.05	50

[a]Standard area (the area covered in all years) is ~134 km^2 (2008 – 2010) and ~135 km^2 in previous years.
[b]Actual area covered by aerial survey (50% coverage) was ~1408 km^2 in 1999 and ~1363 km^2 in 2000 – 2006 and 2008. Coverage was 25% in 2007 and 2010 (~682 km^2) and 27% in 2009 (~736 km^2). Pair density calculations are half the bird density calculations reported in ABR, Inc.'s annual reports (Obritschkewitsch and Ritchie 2011).

[8] A nest is considered viable if it contains at least one viable egg.

Steller's Eider Recovery Criteria

The Steller's Eider Recovery Plan (USFWS 2002) presents research and management priorities that are re-evaluated and adjusted periodically, with the objective of recovery so that protection under the ESA is no longer required. When the Alaska-breeding population was listed as threatened, factors causing the decline were unknown, although possible causes identified were increased predation, overhunting, ingestion of spent lead shot in wetlands, and habitat loss from development. Since listing, other potential threats have been identified, including exposure to other contaminants, disturbance caused during scientific research, and climate change, but causes of decline and obstacles to recovery remain poorly understood.

Criteria used to determine when species are recovered are often based on historical abundance and distribution, or on the population size required to ensure that extinction risk, based on population modeling, is tolerably low. For Steller's eiders, information on historical abundance is lacking, and demographic parameters needed for accurate population modeling are poorly understood. Therefore, the Recovery Plan for Steller's Eiders (USFWS 2002) establishes interim recovery criteria based on extinction risk, with the assumption that numeric population goals will be developed as demographic parameters become better understood. Under the Recovery Plan, the Alaska-breeding population would be considered for delisting from threatened status if it has $\leq$ 1% probability of extinction in the next 100 years, and each of the northern and western subpopulations are stable or increasing and have $\leq$ 10% probability of extinction in 100 years.

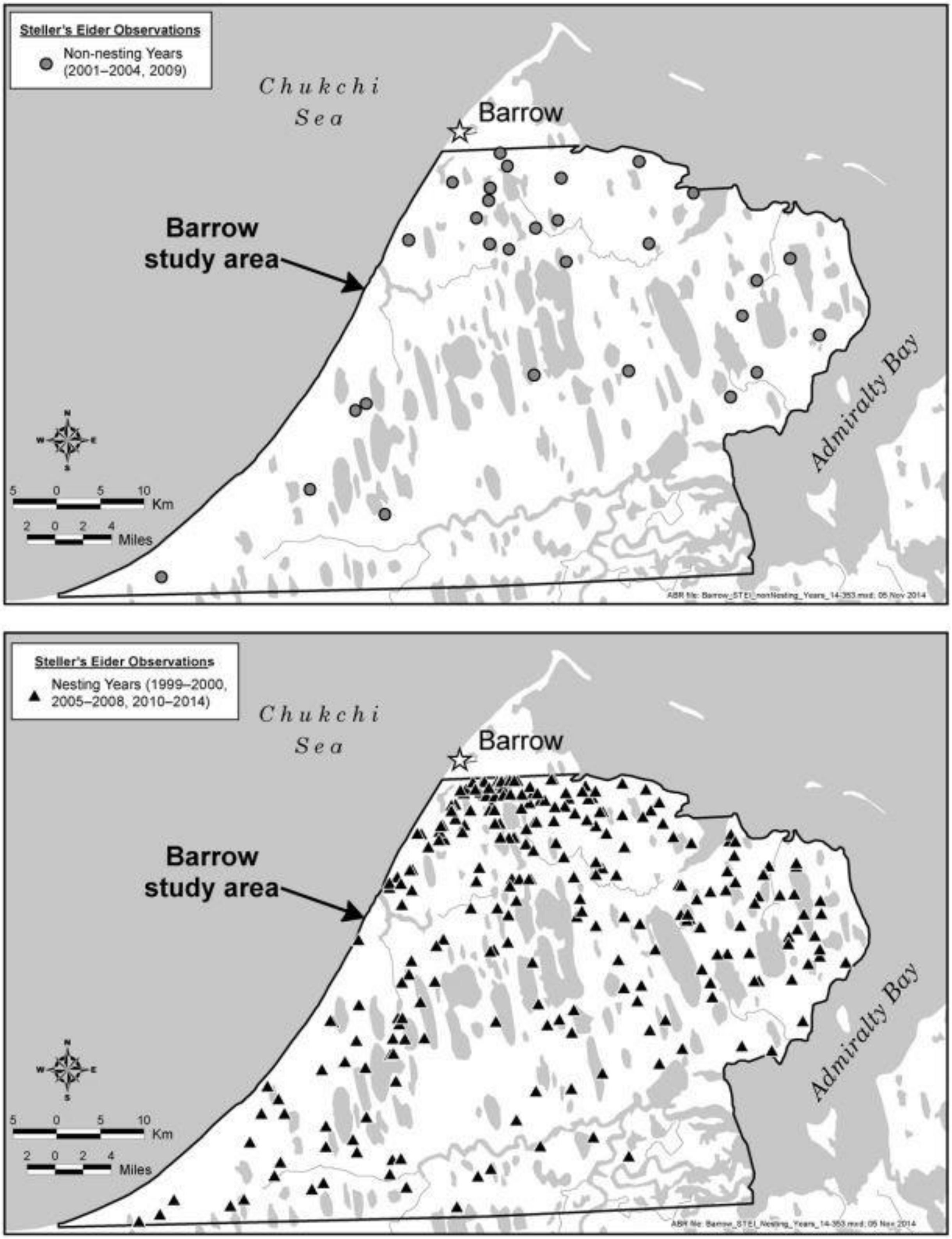

Figure 6.10. Locations of Steller's Eiders observed by ABR, Inc. during aerial surveys in non-nesting (top) and nesting years (bottom) near Utqiaġvik, Alaska, June 1999–2014 (Obritschkewitsch and Ritchie 2015).

6.4 Polar bear

Status and distribution

Due to threats to sea ice habitat, on May 15, 2008, the Service listed the polar bear as threatened under the ESA (73 FR 28212) throughout its range. In the U.S., the polar bear is also protected under the MMPA and the Convention on International Trade in Endangered Species of Wildlife Fauna and Flora.

Polar bears are widely distributed throughout the Arctic where the sea is ice-covered for large portions of the year. Polar bears throughout their range are subdivided into 19 recognized subpopulations or stocks (Figure 6.11). The U.S. contains portions of two subpopulations: the Chukchi Sea (CS) (also called the Alaska-Chukotka subpopulation in the U.S.–Russia Bilateral Agreement) and the Southern Beaufort Sea (SBS) subpopulation.

Population size estimates and trends

The most current global population estimate for polar bears is approximately 26,000 individuals (95 % CI = 22,000-31,000; Wiig et al. (2015). Regarding population trends, the International Union for Conservation of Nature and Natural Resources, Species Survival Commission (IUCN/SSC) Polar Bear Specialist Group (PBSG) ranked three of the 19 subpopulations as "declining," including the SBS subpopulation, and nine, including the CS subpopulation, as "data deficient." They ranked five as "stable" and just two as "increasing" (PBSG 2016; USFWS 2017a).

Species biology and life history

Polar bears are the largest living bear species (DeMaster and Stirling 1981) with a longer neck and proportionally smaller head than other ursids. They are sexually dimorphic; females weigh 400 to 700 pounds (lbs) and males up to 1,440 lbs (USFWS 2017a).

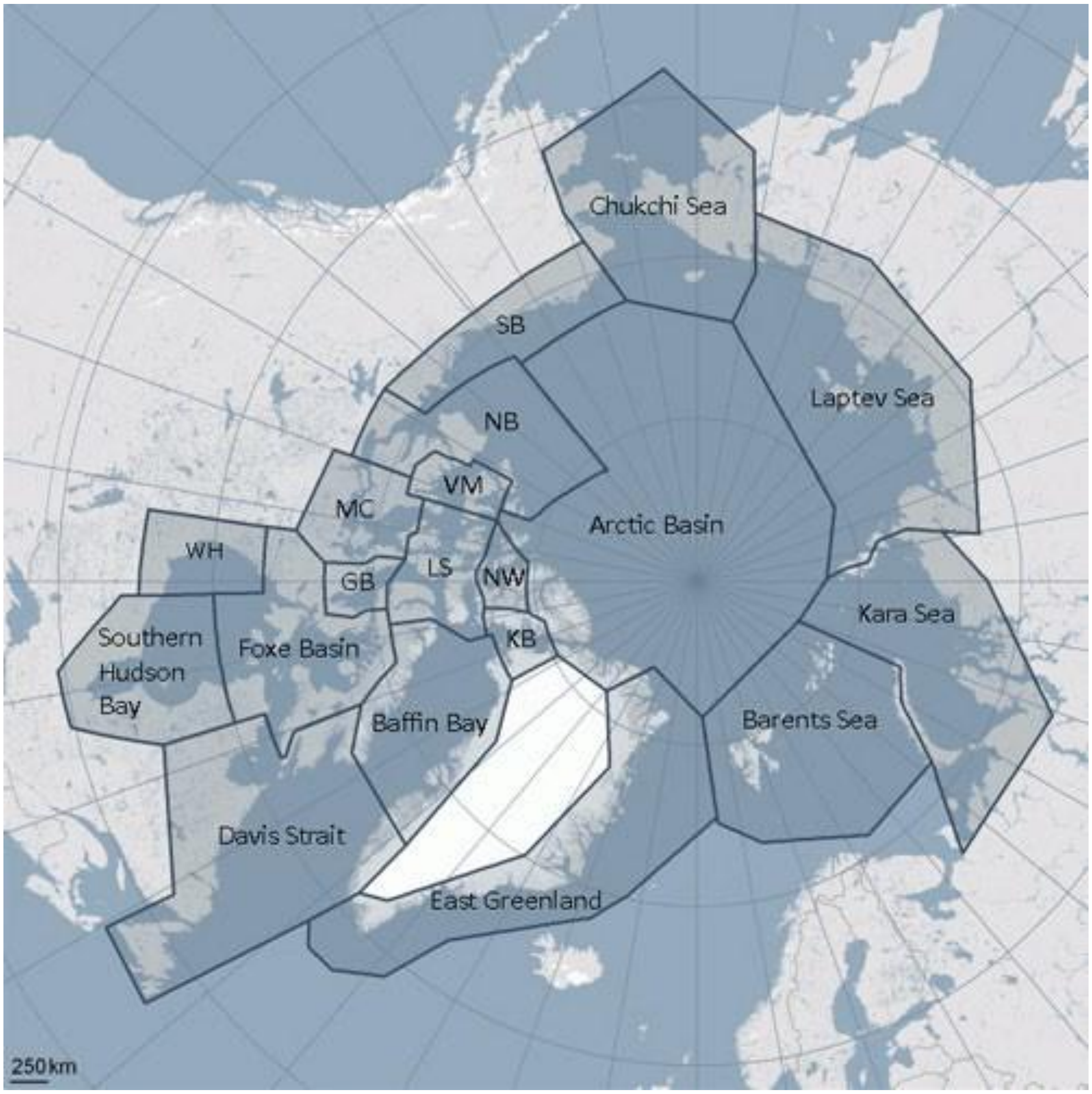

Figure 6.11. Global distribution of polar bear subpopulations as defined by the Polar Bear Specialist Group (Obbard et al. 2010; http://pbsg.npolar.no/en/status/population-map.html). Subpopulations include the Southern Beaufort Sea (SBS), Chukchi Sea, Laptev Sea, Kara Sea, Barents Sea, East Greenland, Northern Beaufort (NB), Kane Basin (KB), Norwegian Bay (NW), Lancaster Sound (LS), Gulf of Boothia (GB), McClintock Channel (MC), Viscount Melville (VM), Baffin Bay, Davis Strait, Foxe Basin, Western Hudson Bay (WH), and Southern Hudson Bay.

Breeding and reproduction – Polar bears are a K-selected species, characterized by late sexual maturity, small litter sizes, and extended maternal investment in raising young. All of these factors contribute to the species' low reproductive rate (Amstrup 2003). Females generally mature and breed for the first time at 4 or 5 years and give birth at 5 or 6 years of age. Litters of two cubs are most common, but 3-cub litters are seen on occasion across the Arctic (Amstrup 2003). The minimum reproductive interval for adult females is three years. Cubs stay with their mothers until weaning, which occurs most commonly in early spring when cubs are 2 1/2 years old. Female bears are available to breed again after their cubs are weaned (USFWS 2017a).

Survival – Polar bears are long-lived and are not generally susceptible to disease or parasites. Due to extended maternal care of young and low reproductive rates, polar bears require high adult survival rates, particularly of females, to maintain population levels (Eberhardt 1985; Amstrup and Durner 1995). Survival rates are generally age dependent, with cubs-of-the-year having the lowest rates and prime-age adults (prime reproductive years are between approximately 5 and 20 years of age) having survival rates that can exceed 90 percent (Regehr et al. 2007a). Survival rates exceeding 90 percent for adult females are essential to sustain polar bear populations (Amstrup and Durner 1995).

Changes in body condition have been shown to affect bear survival and reproduction, which could, in turn, have population-level effects (Regehr et al. 2010; Rode et al. 2010). Survival of polar bear cubs-of-the-year has been directly linked to their weight and the weight of their mothers, with lower weights resulting in reduced survival (Derocher and Stirling 1996; Stirling et al. 1999). Changes in body condition indices were documented in the Western Hudson Bay subpopulation before a statistically significant decline in that subpopulation was documented (Regehr et al. 2007b). Thus, changes in these indices may signal that reductions in survival and abundance are imminent (USFWS 2017a).

Feeding – Polar bears are top predators in the Arctic marine ecosystem. They prey heavily on ice-seals, principally ringed seals (*Phoca hispida*), and to a lesser extent, bearded seals (*Erignathus barbatus*). Areas near ice edges, leads, or polynyas where ocean depth is minimal are the most productive hunting grounds (Durner et al. 2004). Bears occasionally take larger animals, such as walruses (*Odobenus rosmarus*) and belugas (*Delphinapterus leucas*) (Kiliaan and Stirling 1978).

Bowhead whale carcasses, leftover after subsistence harvest, have been available to polar bears as a food source on the North Slope since the early 1970s (Koski et al. 2005). The use of whale carcasses as a food source likely varies among individuals and years. Stable isotope analysis of polar bears in 2003 and 2004 suggested that bowhead whale carcasses comprised 11%-26% (95% CI) of the diets of sampled polar bears in 2003, and 0%-14% (95% CI) in 2004 (Bentzen et al. 2007).

Threats to the polar bear

Because the polar bear depends on sea ice for its survival, loss of sea ice due to climate change is its largest threat worldwide, although polar bear subpopulations face different combinations of human-induced threats (73 FR 28212; Obbard et al. 2010). The largest direct human-caused loss of polar bears is from subsistence hunting, but for most subpopulations where subsistence hunting of polar bears occurs, it is a regulated and/or monitored activity (Obbard et al. 2010). A thorough account of subsistence hunting, sport harvest, poaching, defense-of-life removals, and the management systems controlling these direct removal activities can be found in USFWS (2017b). Other threats include accumulation of persistent organic pollutants in polar bear tissue, tourism, human-bear conflict, and increased development in the Arctic (Obbard et al. 2010).

Climate change – As stated in the Polar Bear Conservation Management Plan (PBCMP) (USFWS 2016a), polar bears evolved over thousands of years to life in a sea ice-dominated ecosystem and depend on sea ice for essential life functions. Climate-induced habitat degradation and loss are negatively affecting some polar bear subpopulations, and unabated global warming is expected to reduce the worldwide polar bear population (Obbard et al. 2010). Patterns of increased temperatures, earlier spring thaw, later fall freeze-up, increased rain-on-snow events (which may cause dens to collapse), and potential reductions in snowfall are also occurring. Loss of sea ice habitat due to climate change is identified as the primary threat to polar bears (73 FR 28212; Schliebe et al. 2006; Obbard et al. 2010).

The sea ice ecosystem supports ringed seals and other marine mammals that comprise the polar bear's prey base (Stirling and Archibald 1977; Smith 1980, 1985; Iverson et al. 2006). Sea ice cover is shown to be strongly, negatively correlated with surface temperature, which is increasing at about 3 times the global average in the Arctic (Comiso 2012). Declines in sea ice area more pronounced in summer than winter (NSIDC 2011a; b). The mean linear rate of decline for August sea ice extent is 29,000 square miles per year, or 10.4 percent per decade since 1979 relative to the 1981 to 2010 average (NSIDC 2018). Thus, average Arctic sea ice extent in August is approximately 40% less now than 40 years ago. Positive feedback systems (i.e., sea-ice albedo) and naturally occurring events, such as warm water intrusion into the Arctic and changing atmospheric wind patterns, can cause fragmentation of sea ice, reduction in the extent and area of sea ice in all seasons, retraction of sea ice away from productive continental shelf areas throughout the polar basin, reduction of the amount of heavier and more stable multi-year ice, and declining thickness and quality of shore-fast ice (Parkinson et al. 1999; Rothrock et al. 1999; Comiso 2003, 2006; Fowler et al. 2004; Lindsay and Zhang 2005; Holland et al. 2006; Serreze et al. 2007; Stroeve et al. 2008).

Loss of access to prey – The decline of sea ice habitat due to changing climate is affecting the ability of polar bears to forage in several ways. Sea ice provides a platform for hunting and feeding, seeking mates and breeding, denning, resting, and for long-distance movement. Polar bears depend on sea ice to hunt seals, and temporal and spatial availability of sea ice is predicted to decline. Once sea ice concentration drops below 50 percent, polar bears have been documented to abandon sea ice for land, where access to their primary prey is almost entirely absent, or they may retreat northward with more consolidated pack ice over the polar basin, which is likely less productive foraging habitat (Whiteman et al. 2015). In either case, polar bears are likely to have reduced access to prey resources (Whiteman et al. 2015). Ware et al. (2017) found that polar bears are increasingly occurring on ice over less-productive waters in summer. Although polar bears occasionally capture ringed seals in open water (Furnell and Oolooyuk 1980), typically ice seals in open water are inaccessible to polar bears (Harwood and Stirling 1992). Thus, species experts do not believe that polar bears will readily adapt to the loss of sea ice by adopting other hunting methods, such as hunting seals in ice-free water (Stirling and Derocher 1993; Derocher et al. 2004).

Effects of climate change on polar bear prey species – Ice seals, principally ringed seals, and to a lesser extent bearded seals, are the primary prey of polar bears, although other food sources are occasionally exploited (USFWS 2017a). Climate change and the loss of Arctic sea ice are expected to affect ice seal populations significantly, and in response in 2012 the NMFS listed the Arctic subspecies of ringed seal (*Phoca hispida hispida*) and the Beringia DPS of the bearded seal (*Erignathus barbatus nauticus*) as threatened species under the Act (77 FR 76706; 77 FR 76740).

Ice seal population dynamics reflect a complex mix of biotic and abiotic factors (Pilfold et al. 2015), making it difficult to accurately assess the effects of changes in sea ice. However, several mechanisms by which a warming environment have affected ice seals, or plausibly should be expected to, have been identified. An adequate snow layer providing insulation around birth lairs is crucial for thermoregulation and survival of young pups (Stirling and Smith 2004). Pups in lairs with thin snow roofs are also more vulnerable to predation than pups in lairs with thick roofs (Hammill and Smith 1991; Ferguson et al. 2005), and when lack of snow cover has forced birthing to occur in the open, nearly 100% of pups died (Smith and Lydersen 1991; Smith et al. 1991). Rain-on-snow events during the late winter are increasing in frequency and can damage or eliminate snow-covered pupping lairs (ACIA 2005). Exposed pups are then vulnerable to hypothermia and predation by polar bears and arctic foxes (*Alopex lagopus*) (Stirling and Smith 2004). Pupping habitat on landfast ice (McLaren 1958; Burns 1970) and drifting pack ice (Wiig et al. 1999; Lydersen et al. 2004) can also be affected by earlier warming and break-up in the spring, which shortens the length of time pups have to grow and mature (Kelly 2001; Smith and Harwood 2001).

Although the rate and extent of population-level response of ice seals to changes in sea ice conditions remain unclear, effects to ice seal populations will certainly affect polar bear populations. Polar bear populations fluctuate with prey abundance (Stirling and Lunn 1997), and regional declines in ringed and bearded seal numbers and productivity have been linked to marked declines in the associated polar bear subpopulations (Stirling and Øritsland 1995; Stirling 2002).

Redistribution of polar bears in response to changes in sea ice – Several studies have shown that changes in sea ice, including the timing of melt in spring and freeze-up in fall, correlate with changes in the distribution of polar bears and their body condition or other indices of fitness. In Western Hudson Bay, sea ice break-up now occurs approximately 2.5 weeks earlier than it did 30 years ago because of increasing spring temperatures (Stirling et al. 1999; Stirling and Parkinson 2006), which is also correlated with when female bears come ashore and when they are able to return to the ice (Cherry et al. 2009). Similarly, changes in summer sea ice conditions have resulted in an increase in the time spent on shore during summer and the proportion of the population on shore in the Southern Beaufort Sea and Chukchi Sea subpopulations (Rode et al. 2015; Atwood et al. 2016). Rode et al. (2015) also found that changes in sea ice likely explain shifts in summer distribution of the Chukchi Sea subpopulation, from use of both Alaskan and Russian coastal areas before reductions in sea ice, to almost exclusive use of coastal areas in Russia after reductions in sea ice.

Changes in the distribution of polar bears in response to changes in sea ice may increase exposure to some threats. If bears spend more time on land during the open water period, there is potential for increased disease transmission (Kirk et al. 2010; Prop et al. 2015; Wiig et al. 2015), particularly where bears concentrate at dwindling food resources (e.g., remains of subsistence-harvested whales at Barter Island, Cross Island, and Point Barrow). Aggregations could also increase the number of individuals exposed in the event of oil spills (BOEM 2014). Increased use of onshore habitat by polar bears has also led to an increase in human-polar bear conflicts (Dyck 2006; Towns et al. 2009). In two studies from northern Canada, researchers found that the majority of polar bears killed in defense of human life occurred during the open water season (Stenhouse et al. 1988; Dyck 2006). Thus, as more bears come on shore during summer, remain on shore longer, and become increasingly food-stressed, the risk of human conflict increases along with a probable increase in defense-of-life kills.

Demographic response – Reduced access to preferred prey (i.e., ice seals; Thiemann et al. 2008) is likely to have demographic effects on polar bears. For example, in the Southern Beaufort Sea subpopulation, the period when sea ice is over the continental shelf has decreased significantly over the past decade, resulting in reduced body mass and productivity (Rode et al. 2010, 2014) and likely reduced population size (Bromaghin et al. 2015).

Changes in movements and seasonal distributions caused by climate change have been shown to affect polar bear nutrition and body condition (Stirling and Derocher 2012). Declining reproductive rates, subadult survival, and body mass have occurred because of longer fasting periods on land resulting from progressively earlier ice break-ups (Stirling et al. 1999; Derocher et al. 2004). Rode et al. (2010) suggested that declining sea ice has resulted in reduced body size and reproductive rates in the Southern Beaufort Sea subpopulation, and Regehr et al. (2007a) found that reduced sea ice habitat correlated with a reduction in the number of yearlings produced per female. In the Western Hudson Bay subpopulation, sea ice related declines in vital rates led to reduced abundance and declining population trends (Regehr et al. 2007b).

To date, however, researchers have documented demographic effects of sea ice loss in only a few of the 19 polar bear subpopulations (Regehr et al. 2007a; Rode et al. 2012). Rode et al. (2014) found that even though sea ice loss during summer had been substantial in the Chukchi Sea, polar bears in that subpopulation had not yet exhibited concomitant declines in body mass or productivity.

Reduced denning success – Climate change could negatively influence polar bear denning (Derocher et al. 2004). Insufficient snow would prevent den construction or result in use of poor sites where the roof could collapse (Derocher et al. 2004). Changes in the amount and timing of snowfall could also impact the thermal properties of dens, and because cubs are born helpless and remain in the den for three months before emergence, major changes in the thermal properties of dens could negatively impact cub survival (Derocher et al. 2004). Unusual rain events are projected to increase throughout the Arctic in winter (Liston and Hiemstra 2011), and increased rain in late winter and early spring could cause den collapse (Stirling and Smith 2004). The proportion of bears denning on ice has decreased for some subpopulations (Atwood et al. 2016) and not others, but the consequences of these shifts to cub survival are unknown.

While polar bears can successfully den on sea ice (Amstrup and Gardner 1994; Fischbach et al. 2007), for most subpopulations, maternity dens are located on land (Derocher et al. 2004). Female polar bears can repeatedly return to specific denning areas on land (Harington 1968; Ramsay and Stirling 1990; Amstrup and Gardner 1994). For bears to access preferred denning areas on land, pack ice must drift close enough or freeze sufficiently early to allow pregnant females to walk or swim to the area by late October or early November (Derocher et al. 2004). As distance increases between the pack ice edge and coastal denning areas, it will become increasingly difficult for females to access terrestrial denning locations unless they are already on or near land. Distance between the ice edge and shore is one factor thought to limit denning in western Alaska in the CS subpopulation (Rode et al. 2015). Increased travel distances could negatively affect denning success and ultimately population size of polar bears (Aars et al. 2006).

For example, over the last two decades, the Southern Beaufort Sea subpopulation has experienced a marked decline in summer sea-ice extent, along with pronounced lengthening of the open-water season (Stroeve et al. 2014; Stern and Laidre 2016). The dramatic changes in extent and phenology of sea-ice habitat have coincided with evidence suggesting use of terrestrial habitat has increased during open-water periods and prior to denning, including in the Arctic Refuge.

In addition to increased use of land during the open-water season, Southern Beaufort Sea polar bears have also increasingly used land for maternal denning. Olson et al. (2017) examined the choice of denning substrate (land compared to sea ice) by adult females between 1985 and 2013 and determined that the frequency of land-based denning increased over time, constituting 34.4 percent of all dens from 1985 to 1995, 54.6 percent from 1996 to 2006, and 55.2 percent from 2007 to 2013. Additionally, the frequency of land denning was directly related to the distance that sea ice retreated from the coast. From 1985 to 1995 and 2007 to 2013, the average distance from the coast to 50 percent sea ice concentration in September (when sea ice extent reaches its annual minimum) increased 351±55 km (218.10±34.17 mi), while the distance to 15 percent sea ice concentration increased by 275±54 km (170.88±33.55 mi). Rode et al. (2018) determined that reproductive success was greater for females occupying land-based dens compared to ice-based dens, which may be an additional factor contributing to an individual's increase of land-based den sites.

Under most climate-change scenarios, the distance between the edge of the pack ice and land will increase during summer. Bergen et al. (2007) found that between 1979 and 2006, the minimum distance polar bears traveled to denning habitats in northeast Alaska increased by an average rate of 3.7-5.0 miles per year, have nearly doubled since 1992, and would likely increase threefold by 2060. Comiso (2002) predicted that under future climate change scenarios (i.e., by the 2050s), pregnant female polar bears will be unable to access many of the most important denning areas in the north coast of the central Beaufort Sea (Derocher et al. 2004).

Shipping and transportation – A decline in Arctic sea ice has increased the navigability of Arctic waters, with previously ice-covered sea routes now opening in summer, allowing access for commercial shipping, natural resource development, and tourism. Potential effects include fracturing of sea ice, disturbance of polar bears and their prey, increased human-polar bear encounters, introduction of waste/ litter and toxic pollutants into the environment, and increased risk of oil spills (PBRS 2015; USFWS 2017a). Although shipping is expected to increase in Arctic waters in response to declining sea ice, the PBCMP concluded that trans-Arctic shipping poses minimal risk to polar bears in the long-term (USFWS 2016a). Arctic nations are increasingly working cooperatively to track changes in shipping and manage possible increases in environmental impacts (USFWS 2017a).

Oil and gas development – Polar bears overlap with both active and planned oil and gas operations throughout their range. Impacts on polar bears from industrial activities, such as oil and gas development, may include: disturbance from increasing human-bear interactions, resulting in direct displacement of polar bears, preclusion of polar bear use of preferred habitat (most notably, denning habitat); and/or displacement of primary prey. At the time of listing, the greatest level of oil and gas activity occurring within polar bear habitat was in the United States (Alaska). The Service determined that direct impacts on polar bears from oil and gas exploration, development, and production activities had been minimal and did not threaten the species overall. This conclusion was based primarily on: 1) the relatively limited and localized nature of the development activities; 2) existing mitigation measures that were in place; and 3) the availability of suitable alternative habitat for polar bears (USFWS 2017a).

Although oil and gas exploration, development, and production throughout the Arctic has declined since the time of the listing, offshore oil and gas activities may increase due to a decline in summer sea ice (USFWS 2016a, 2017b). Plans are also underway for new oil and gas development and infrastructure in polar bear habitat (e.g., natural gas pipeline from Mackenzie Delta to southern Canada, exploration offshore from Greenland, Russia, and Alaska [Beaufort Sea]), and proposed offshore and onshore lease sales . In the United States, potential effects on polar bears are in part mitigated through: 1) development of activity-specific human-bear interaction plans (to avoid disturbance), 2) safety and deterrence training for industry staff, 3) bear monitoring and reporting requirements, and 4) implementation of project-specific protection measures (e.g., 1 mile buffers around den sites).

Contaminants – In the final rule listing the polar bear as a threatened species, the Service identified three categories of contaminants in the Arctic that present the greatest potential threats to polar bears and other marine mammals, these are persistent organic pollutants, heavy metals, and petroleum hydrocarbons (PCBs) (73 FR 28288-28291). In the PBCMP (USFWS 2016a), the Service concluded that contaminant concentrations were not thought to have population level effects on most polar bear populations, but noted that contaminants may become a threat in the future, especially in subpopulations experiencing declines related to nutritional stress brought on by sea ice loss and environmental changes.

Petroleum hydrocarbons/oil spills – Oil spills could potentially affect polar bears through: 1) affecting their ability to thermoregulate if their fur is oiled, 2) lethal or sublethal effects of ingestion of oil from grooming or eating contaminated prey, 3) habitat loss or decreased availability of preferred habitat; and 4) impacts to the abundance or health of prey. At the time of listing, no major oil spills had occurred in the marine environment within the range of polar bears and the Service had determined that the probability of a large oil spill occurring in polar bear habitat was low. We also noted that, in Alaska: 1) previous operations in the Beaufort and Chukchi seas have been conducted safely, and effects on wildlife and the environment have been minimized; 2) regulations exist to require pollution prevention and control; and 3) plans are reviewed by both leasing and wildlife agencies to ensure appropriate species-specific protective measures for polar bears are included. However, we also noted that increased oil and gas development coupled with increased shipping elevated the potential for spills, and if a large spill were to occur, it could have significant impacts to polar bears and their prey, depending on the size, location, and timing of the spill.

Persistent Organic Pollutants (POPs) – Persistent organic pollutants are organic chemicals resistant to biodegradation, and can affect apex predators such as polar bears that have low reproductive rates and high lipid levels because POPs tend to bioaccumulate and biomagnify in fatty tissues. While the levels of some contaminants, such as PCBs, generally seem to be decreasing in polar bears, others, such as hexachlorocyclohexanes, were relatively high, and newer compounds, such as polybrominated diphenyl ethers and perflouro-octane sulfonates, posed a potential future risk to polar bears. The effects of these contaminants at the population level are relatively unknown (USFWS 2017a).

Metals – The most toxic or abundant elements in marine mammals are mercury, cadmium, selenium, and lead. Of these, mercury is of greatest concern because of its potential toxicity at relatively low concentrations and its tendency to bioaccumulate and biomagnify in the food web (73 FR 28291). In the final rule to list the polar bear (73 RF 28212) the Service noted that although mercury found in marine mammals often exceed levels that have caused effects in terrestrial mammals, most marine mammals appear to have evolved mechanisms that allow tolerance of higher concentrations of mercury (AMAP 2005). Although population-level effects are still widely undocumented for most polar bear subpopulations, increasing exposure to contaminants may become a more significant threat in the future, especially for declining polar bear subpopulations and/or bears experiencing nutritional stress (USFWS 2017a).

Ecotourism – Polar bear viewing and photography are popular forms of tourism that occur primarily in Churchill, Canada; Svalbard, Norway; and the north coast of Alaska (near the communities of Kaktovik and Utqiaġvik). In the final listing rule for the polar bear, the Service noted that, while it is unlikely that properly regulated tourism will have a negative effect on polar bear subpopulations, increasing levels of public viewing and photography in polar bear habitat might lead to increased human-polar bear interactions. Tourism can also result in inadvertent displacement of polar bears from preferred habitats or alter natural behaviors (Lentfer 1990; Dyck and Baydack 2004; Eckhardt 2005). Conversely, tourism can have the positive effect of increasing the worldwide constituency of people with an interest in polar bears and their conservation (USFWS 2017a).

6.5 Polar bear critical habitat

The polar bear was listed as a threatened species throughout its range, but the regulatory authority to designate critical habitat (50 CFR 424.12(h)) is limited to areas of U.S. jurisdiction, which in the case of the polar bear includes Alaska and adjacent territorial and U.S. waters. The Service designated 484,734 square kilometers of critical habitat for the polar bear in 2010 (75 FR 76086).

Description of Polar Bear Critical Habitat

Designation of critical habitat requires, within the geographical area occupied by the polar bear, identification of the physical or biological features (PBFs) essential to the conservation of the species that may require special management or protection. We identified the following three PBFs essential to the conservation of the polar bear:

1) Sea-ice habitat used for feeding, breeding, denning, and movement, which is further defined as sea-ice over waters 300 m or less in depth that occurs over the continental shelf with adequate prey resources (primarily ringed and bearded seals) to support polar bears.
2) Terrestrial denning habitat, which includes topographic features, such as coastal bluffs and riverbanks, with suitable macrohabitat characteristics. Suitable macrohabitat characteristics are:
    a) Steep, stable slopes (range 15.5–50.0 degrees), with heights ranging from 1.3 to 34 m, and with water or relatively level ground below the slope and relatively flat terrain above the slope;
    b) Unobstructed, undisturbed access between den sites and the coast;
    c) Sea-ice in proximity to terrestrial denning habitat prior to the onset of denning during the fall to provide access to terrestrial den sites; and
    d) The absence of disturbance from humans and human activities that might attract other polar bears.
3) Barrier island habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal den and optimal feeding habitat, including all barrier islands along the Alaska coast and their associated spits, within the range of the polar bear in the United States, and the water, ice, and terrestrial habitat within 1.6 km of these islands.

Considering the three PBFs, and the quantity and spatial arrangement of them necessary to support conservation of the polar bear, we designated the following three critical habitat units, each of which contains at least one of the PBFs:

Unit 1, Sea Ice Habitat – Sea ice habitat covers approximately 464,924 km^2 of primarily marine habitat extending from the mean high tide line of the Alaska coast seaward to the 300 m depth contour, and spans west to the international date line, north to the Exclusive Economic Zone, east to the US–Canada border, and south to the southern limit of the known distribution of the Chukchi Sea polar bear subpopulation. Sea ice is used by polar bears for the majority of their life cycle for activities such as hunting seals, breeding, denning, and traveling.

Unit 2, Terrestrial Denning Habitat – Terrestrial denning habitat occurs within approximately 14,652 km^2 of land along the northern coast of Alaska from the Canadian border west to near Point Barrow. It encompasses approximately 95 percent of the known historical terrestrial den sites from the Southern Beaufort Sea subpopulation (Durner et al. 2009a). The inland extent of denning distinctly varies between two longitudinal zones, with 95 percent of known dens between the Alaska/Canada border and Kavik River occurring within 32 km of the mainland coast, and 95 percent of dens between the Kavik River and Utqiaġvik occurring within 8 km of the mainland coast. The inland boundary of the Terrestrial Denning Unit reflects this difference in the distribution of known den sites, with the boundary drawn at 32 km inland between the Alaska/Canada border and the Kavik River and 8 km inland between the Kavik River and Utqiaġvik.

Unit 3, Barrier Island Habitat – Barrier island habitat covers approximately 10,575 km^2 of barrier islands and the associated complex of spits, water, ice, and terrestrial habitats within 1.6 km of barrier islands. There is significant overlap between this unit and the Terrestrial Denning and Sea Ice units. Similar to the Sea Ice Unit, the Barrier Island Unit extends from near the Alaska/Canada Border to near Hooper Bay in southwestern Alaska but only occurs where barrier islands exist.

Exclusions within Designated Polar Bear Critical Habitat – Within the Terrestrial Denning and Barrier Island units, critical habitat does not include manmade structures (e.g., houses, gravel roads, airport runways and facilities, pipelines, well heads, generator plants, construction camps, sewage treatment plants, hotels, docks, seawalls, and the land on which they were constructed) that existed on the effective date of the rule. The communities of Utqiaġvik and Kaktovik were also excluded.

7. ENVIRONMENTAL BASELINE

The environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences of the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

7.1 Baseline of listed eiders within the terrestrial portion of the Action Area

Listed eiders in the terrestrial Action Area

Steller's eiders are extremely unlikely to occur within the terrestrial portion of the Action Area. Therefore, the baseline of Steller's eiders relative to the Action Area is limited to areas of overlap with the MTR, described further below.

Spectacled eiders are present in the terrestrial portions of the Action Area at low density from late May through late October. In summer, spectacled eiders are widely distributed near lakes or coastal margins throughout the North Slope with a trend toward higher abundance near the coast, north of Teshekpuk Lake, and within the Barrow Triangle (Figure 6.2). Within the terrestrial portion of the Action Area, spectacled eiders nest primarily in non-patterned wet meadows, and in wetland complexes containing emergent grasses and sedges (Anderson and Cooper 1994; Anderson et al. 2009). After hatching, spectacled eider hens and broods occupy deep *Arctophila* and shallow *Carex* habitat (Safine 2011).

Because the terrestrial portion of Action Area is located within a remote national wildlife refuge, industrial development, human habitation, and disturbance have been extremely limited to date. There is no existing industrial development within the terrestrial portion of the Action Area, although oil and gas development occurs immediately adjacent to the west (e.g., Liberty, Badami, and Point Thomson). The community of Kaktovik is the only year-round human habitation within the Action Area. Therefore, although long-term habitat loss through human development or disturbance is occurring throughout part of the species' range, it is not impacting spectacled eider habitat within the terrestrial portion of the Action Area.

However, other factors which may have contributed to the current threatened status of spectacled eiders include: environmental contaminants; increased predator populations; subsistence harvest; recreation and research; and climate change.

Environmental contaminants

Deposition of lead shot in tundra wetlands and shallow marine habitat where eiders forage is considered a threat to listed eiders. Lead poisoning of spectacled eiders has been documented on the YK-Delta (Franson et al. 1995; Grand et al. 1998) and in Steller's eiders on the ACP (Trust et al. 1997; Service unpublished data). Waterfowl hunting with lead shot is prohibited in Alaska, and for hunting all birds on the North Slope. However, it may persist in the environment and may still be used by hunters in some areas (Service, unpublished data). Lead deposition in tundra wetlands would likely be limited to areas adjacent to the community of Kaktovik and frequently used travel corridors, and the concentration of lead presumably would decline with increasing distance from these areas. Although the use of lead shot appears to be declining, residual lead shot may be present in the environment and be available to waterfowl for some unknown period into the future.

Other contaminants such as globally distributed heavy metals, may also affect listed eiders. For example, spectacled eiders sampled in winter near St. Lawrence Island exhibited high concentrations of metals, as well as subtle biochemical changes (Trust et al. 2000). However, risk of contaminant exposure and potential effects to spectacled eiders in the Action Area are limited primarily to sources outside of the area.

Increased predator populations

Predator and scavenger populations have likely increased near rural communities and industrial infrastructure on the ACP in recent decades (Eberhardt et al. 1983; Day 1998; Powell and Backensto 2009). Reduced fox trapping, anthropogenic food sources in rural communities, and an increase in availability of nesting/denning sites at human-built structures may have resulted in increased numbers of arctic foxes (*Alopex lagopus*), common ravens (*Corvus corax*), and glaucous gulls (*Larus hyperboreus*) in developed areas of the ACP (Day 1998). For example, ravens are highly efficient egg predators (Day 1998), and have been observed depredating Steller's eider nests near Utqiaġvik (Quakenbush et al. 2004). Ravens also appear to have expanded their breeding range on the ACP by using manmade structures for nest sites (Day 1998). Therefore, as the number of structures and anthropogenic attractants associated with human habitation increase, reproductive success of spectacled eiders may decrease, although to date, anthropogenically influenced increases in predator abundance in the Program Area have been limited to the vicinity Kaktovik. Because 1) the low density of spectacled eiders in the terrestrial portion of the Action Area, 2) increasing predator populations likely diminishing with increasing distance from human habitation, and 3) areas with increased predator populations overlapping a very small subset of the action area; increased predator populations have likely had a minimal impact on spectacled eiders in the Action Area.

Subsistence harvest
Although local knowledge suggests spectacled eiders were not specifically targeted for subsistence, an unknown level of harvest occurred across the North Slope prior to listing spectacled eiders under the ESA (Braund et al. 1993). All harvest of spectacled eiders was closed in 1991 by Alaska State regulations, and outreach efforts have been conducted by the Service, the BLM, and the North Slope Borough to encourage compliance. However, annual harvest data indicate that at least some listed eiders continue to be inadvertently or deliberately taken during subsistence activities on the North Slope. Annual intra-Service consultations are conducted for the Migratory Bird Subsistence Hunting Regulations, and although estimates are imprecise, harvest of all migratory bird species, including listed eiders, is reported annually.

Instances of inadvertent harvest would likely be concentrated near the community of Kaktovik, and we expect the frequency of inadvertent harvest would decline with increasing distance from the community as access becomes more difficult. Furthermore, due to low density of spectacled eiders in the terrestrial portion of the Action Area, harvest of spectacled eiders is likely rare.

Recreation and research
All commercial guiding or outfitters operating in the Arctic Refuge require a commercial use permit from the Refuge. In 2017, Arctic Refuge issued 19 permits for air operator businesses, 21 permits for recreational guide businesses, and 11 hunting guide businesses. While it is difficult to track the number of visitors to Arctic Refuge, it is estimated that over the last five years, a minimum of 11,333 client use days occurred in the Coastal Plain of Arctic Refuge. Visitors engaged predominantly in polar bear viewing, river floating, backpacking, base camping, birding, wildlife watching, photography, fishing, and hunting (Jennifer Reed, Visitors Services Coordinator, Arctic Refuge, USFWS, Pers. Comm.).

Field-based scientific research has also increased in the Arctic in response to interest in climate change and its effects on Arctic ecosystems. While some activities have no impact on spectacled eiders (e.g., project timing occurs when eiders are absent or employs remote sensing tools), aerial surveys, on-tundra activities, or remote aircraft landings may disturb listed eiders. As with recreational use, these activities are considered in intra-Service consultations for special use permits from Arctic Refuge.

Climate change

The environmental baseline includes consideration of ongoing and projected changes in climate which have consequences for listed species in the Action Area. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007). In our analyses, we use our best professional judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

High latitude regions, such as Alaska’s North Slope, are thought to be especially sensitive to effects of climate change (Quinlan et al. 2005; Schindler and Smol 2006; Smol et al. 2005). While climate change will likely affect individual organisms and communities, it is difficult to predict with certainty how these effects will manifest. Biological, climatological, and hydrologic components of the ecosystem are interlinked and operate on varied spatial, temporal, and organizational scales with feedback between components (Hinzman et al. 2005).

There are a wide variety of changes occurring across the circumpolar Arctic. Arctic landscapes are dominated by freshwater wetlands (Quinlan et al. 2005), which listed eiders depend on for forage and brood rearing. As permafrost thaws, some water bodies are draining (Smith et al. 2005; Oechel et al. 1995), or drying due to increased evaporation and evapotranspiration during prolonged ice-free periods (Schindler and Smol 2006; Smol and Douglas 2007). In addition, productivity of some lakes and ponds is increasing in correlation with elevated nutrient inputs from thawing soil (Quinlan et al. 2005; Smol et al. 2005; Hinzman et al. 2005; Chapin et al. 1995) and other changes in water chemistry or temperature are altering algal and invertebrate communities, which form the basis of the Arctic food web (Smol et al. 2005; Quinlan et al. 2005).

With reduced summer sea ice coverage, the frequency and magnitude of coastal storm surges has increased. During these events, coastal lakes and low lying wetlands are often breached, altering soil/water chemistry as well as floral and faunal communities (USGS 2006). When coupled with softer, semi-thawed permafrost, reductions in sea ice have significantly increased coastal erosion rates (USGS 2006), which may reduce available coastal tundra habitat over time.

Changes in precipitation patterns, air and soil temperatures, and water chemistry are also affecting terrestrial communities (Hinzman et al. 2005; Prowse et al. 2006; Chapin et al. 1995), and the range of some boreal vegetation species is expanding northward (Callaghan et al. 2004). Climate-induced shifts in distributions of predators, parasites, and disease vectors may also have significant effects on listed species. Climate change may also cause mismatched phenology among listed eider migration, development of tundra wetland invertebrate stocks, fluctuation of small mammal populations, and corresponding abundance of predators (Callaghan et al. 2004).

In summary, the impacts of climate change are on-going and the ultimate effects on spectacled eiders within the Program Area are unclear. Some species may adapt and thrive under changing environmental conditions, while others decline or suffer reduced biological fitness; it is unknown how spectacled eider populations may be affected.

7.2 Baseline of listed eiders and designated critical habitat in the MTR

Listed eiders

Both Steller's and spectacled eiders occur along the MTR during their migrations. During molt, spectacled eiders are present in the MTR in Ledyard Bay.

While we have some information regarding migration routes of spectacled eiders (e.g., Sexson et al. 2014; Sexson 2015), specific information regarding these routes for Alaska-breeding Steller's eiders is lacking. In spring, spectacled eiders move through leads in the sea ice consistent with patterns exhibited by other sea duck species that migrate from wintering areas in the Bering Sea to breed in coastal Alaska (Sexson et al. 2014). Steller's eiders likely follow a similar migration pattern. In summer and autumn, Steller's eiders return to use open waters along the Chukchi Sea coast, with spectacled eiders remaining in these areas to molt. Large numbers of molting spectacled eiders are present in the Ledyard Bay Critical Habitat Unit (LBCHU) from late June through late October (Larned et al. 1995; Petersen et al. 1999).

A recent study in which spectacled eiders were marked with satellite telemetry devices at coastal areas adjacent to Peard Bay and in the Colville River delta has provided information regarding how the species uses the eastern Chukchi Sea (approximately within 70 km of the coast of northern Alaska) during migration (Sexson et al. 2014; Sexson 2015). Spectacled eiders used this area during pre-breeding migration, breeding, post-breeding migration, and/or post-fledging dispersal. Adult males that used the eastern Chukchi Sea during post-breeding migration arrived in early July and departed in early September, although departure dates varied substantially, ranging from 4 July to 5 October (Sexson et al. 2014). Consequently, sustained occupancy among adult males during post-breeding migration ranged from 30–97 days (Sexson et al. 2014). Adult females that used the eastern Chukchi Sea during post-breeding migration arrived in August and departed in October (Sexson et al. 2014), although the timing of arrival during post-breeding migration varied considerably; arrival occurred as early as 15 July and as late as 28 September. Consequently, the duration of sustained occupancy among adult females during post-breeding migration ranged from 16–84 days. Juveniles that fledged in tundra wetlands near or adjacent to the Beaufort Sea arrived in the eastern Chukchi Sea in early October and stayed for 13–29 days before departing by late October. Thus, spectacled eiders use the eastern Chukchi Sea continuously from pre-breeding staging through post-fledgling dispersal.

Due to the lack of industrial development and minimal human presence and vessel traffic in the region, the Chukchi Sea is currently largely in natural condition. Current industrial impacts are minimal and pollution and/or sediments occur at very low levels in the area. The majority of water flowing into this marine environment is not subject to human activity or stressors and is considered unimpaired (Alaska's Final 2002/2003 Integrated Water Quality Monitoring and Assessment Report). Furthermore, there are no Section 303(d) impaired waterbodies identified within the Arctic Subregion by the State of Alaska. Background hydrocarbon concentrations in the Chukchi Sea appear to be biogenic (naturally occurring) and on the order of 1 part per billion or less; concentrations in the Hope Basin and Chukchi Sea are entirely biogenic in origin and are typical of levels found in unpolluted marine water and sediments. A study of heavy metals in sediments collected from portions of the eastern Chukchi in the 1990's (Naidu 2005) found concentrations were low and the environment was considered "pristine."

Use of the Beaufort Sea by listed eiders varies over time and by breeding status, and is in part controlled by ice cover on the sea surface (Schamel 1978, TERA 2002, Fischer and Larned 2004). Breeding male spectacled eiders generally depart the terrestrial environment in late June when females begin incubation (Anderson and Cooper 1994, Bart and Earnst 2005). Use of the Beaufort Sea by departing males is variable as indicated by satellite telemetry studies (TERA 2002). Of 14 males implanted with transmitters, only 4 spent an extended period of time (11–30 days), in the Beaufort Sea (TERA 2002). Preferred areas were near large river deltas such as the Colville River where open water is more prevalent. Some appeared to move directly to the Chukchi Sea over land, although the majority moved rapidly (average travel of 1.75 days) over nearshore waters from breeding grounds to the Chukchi Sea (TERA 2002).

Females spectacled eiders generally depart the breeding grounds later, when much more of the Beaufort Sea is ice-free, allowing for more extensive use of the area. Females spent an average of 2 weeks in the Beaufort Sea (range 6-30 days) with the western Beaufort Sea the most heavily used (TERA 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than the males (Peterson et al. 1999). This offshore migration route and the greater use of the Beaufort Sea by females is attributed to decreased sea ice later in summer when females migrate through the region (Peterson et al. 1999; TERA 2002).

There are several oil facilities operating or planned in and along the Beaufort Sea coast (e.g., Liberty, Ooguruk, Point Thomson). These facilities could result in small-scale, localized impacts on individual spectacled eiders as is described in the Biological Opinions issued for individual projects (USFWS 2018, 2006, 2012). The structures at these sites pose a potential collision risk for listed eiders migrating in the MTR portion of the Action Area. Birds are particularly at risk of collision when visibility is impaired by darkness or inclement weather (Weir 1976). There is also evidence that lights on structures increase collision risk (Reed et al. 1985; Manville 2000; Russell 2005). Johnson and Richardson (1982), in their study of migratory bird behavior along the Beaufort Sea coast, reported that 88% of eiders flew below an estimated altitude of 10 m (32 ft) and well over half flew below 5 m (16 ft). Thus, structures of almost any height pose a collision risk to migrating eiders.

While no large spills of crude oil have occurred in the Beaufort Sea, small spills of refined petroleum products do occur. These spills decrease habitat quality and pose a risk to migrating eiders. However, there are detailed oil spill contingency plans associated with each development project and spill response limits the area impacts while wildlife hazing reduces the probability an eider would contact spilled product.

Similar to the Chukchi Sea, the area of the Beaufort Sea within the MTR portion of the Action Area is relatively unimpacted by human activity.

Listed Eider Critical Habitat

There is no overlap between terrestrial designated critical habitat for listed eiders and the Action Area. The MTR passes adjacent to the Ledyard Bay Critical Habitat Unit (LBCHU) designated to protect molting spectacled eiders, and a critical habitat unit used by wintering spectacled eiders south of St. Lawrence Island (Figure 6.1B), but it does not overlap with the eastern Norton Sound spectacled eider critical habitat unit or designated Steller's eider critical habitat.

Several key environmental factors, such as good water quality and lack of contamination, contribute to what can be considered the current good environmental conditions of the LBCHU. The LBCHU is currently largely in natural condition, free of physical modification or significant pollutants in either its water and sediments; and its physical and biological processes are functioning and promote production of a rich and abundant benthic community upon which spectacled eiders feed when they occupy the LBCHU.

In wintering critical habitat south of Saint Lawrence Island, spectacled eider's preferred food resources may be in decline and organic deposition and benthic biomass in this area have declined steadily since the late 1980s (66 FR 9146). Oceanographic studies during late winter (March–April 1999) found that particulate organic carbon concentrations in the water column were too low to support significant populations of large zooplankton or krill, indicating that spectacled eiders must be benthic feeders. However, a long-term trend in benthic communities continues: The formerly abundant bivalve *Macoma calcarea* has declined relative to another clam *Nuculana radiata*, which has 76 percent lower lipid content and 26 percent lower energy density (J.R. Lovvorn, Univ. Wyoming, pers. comm. 2000). The average length and mass of bivalves has also declined in the long term (J.M. Grebmeier and B.I. Sirenko, unpubl. data). Because nearly all spectacled eiders spend each winter occupying an area of ocean less than 50 km (27.0 nm) in diameter, they may be particularly vulnerable to environmental changes that appear to be impacting the benthic communities in this area.

7.3 Baseline of the polar bear in the Action Area

Both the Southern Beaufort Sea (SBS) and Chukchi Sea (CS) polar bear subpopulations occur within the Action Area. The subpopulations overlap in the western Beaufort and eastern Chukchi Sea region (Figure 7.1), but can be distinguished by animal movement data and tissue contaminants (Amstrup et al. 2004; Amstrup et al. 2005). The SBS subpopulation also ranges beyond the U.S. into Canada.

The CS subpopulation occurs only in the MTR portion of the Action Area. The highest number of polar bears in the Action Area occurs on land during fall and winter when some polar bears enter the coastal environment as they abandon melting sea ice, forage for terrestrial food (particularly subsistence harvested whale carcasses near Kaktovik), or search for suitable den sites (pregnant females). Bears may also spend some time on land while transiting to other areas. If bears come ashore due to fall storms, melting sea ice, and/or ocean currents, they may remain along the coast or on barrier islands for several weeks until sea ice returns. Polar bears do not use the Chukchi Sea and adjacent Alaska coastline in the same manner they use the Beaufort Sea and the adjacent North Slope (Craig Perham, MMM-FWS, pers. com.). Interactions with polar bears in the SBS subpopulation could occur both onshore and offshore and would likely be related to seasonal variation in sea ice cover and extent.

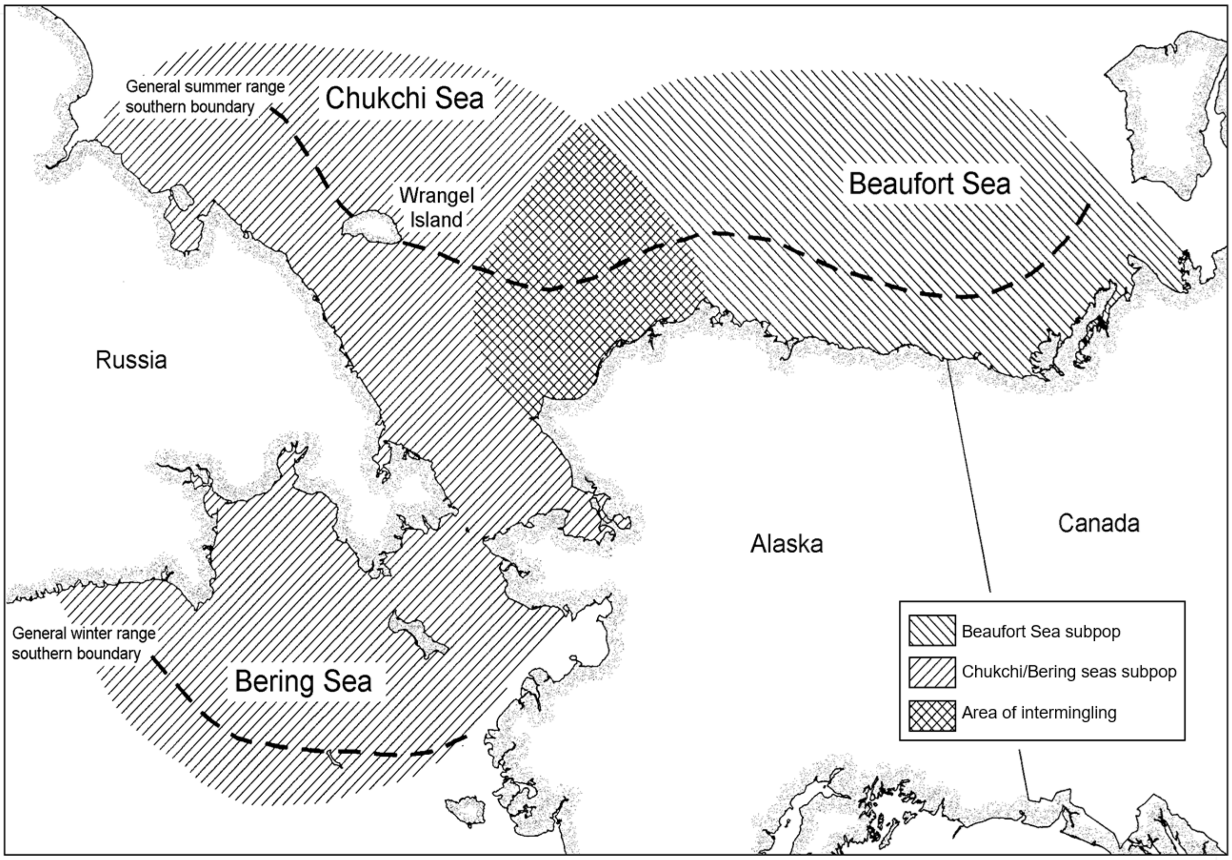

Figure 7.1. Range of polar bear subpopulations in Alaska.

The SBS subpopulation had an estimated population size of approximately 900 bears in 2010 (Bromaghin et al. 2015). This represents a significant reduction from previous estimates of approximately 1,800 in in 1986 (Amstrup et al. 1986) and 1,526 in 2006 (Regehr et al. 2006). In addition, analyses of over 20 years of data on size and body condition of bears in this subpopulation demonstrated declines for most sex and age classes and significant negative relationships between annual sea ice availability and body condition (Rode et al. 2010). This evidence suggests that the SBS subpopulation is currently declining due to sea ice loss (USFWS 2017a).

Polar bears in the SBS subpopulation historically spent the entire year on the sea ice hunting for seals, with the exception of a relatively small proportion of adult females that would come ashore during autumn and overwinter to den. However, over the last two decades, the SBS subpopulation has experienced a marked decline in summer sea-ice extent, along with a pronounced lengthening of the open-water season (period of time between sea ice break-up and freeze-up; Stroeve *et al.* 2014; Stern and Laidre 2016). The dramatic changes in the extent and phenology of sea-ice habitat have coincided with evidence suggesting that use of terrestrial habitat has increased during summer and prior to denning, including in the Coastal Plain of Arctic Refuge.

The CS subpopulation is widely distributed on the pack ice of the northern Bering, Chukchi, and eastern Siberian seas (Garner et al. 1990; Garner et al. 1994; Garner et al. 1995). The constant movement of pack ice influences the movement of polar bears, and this makes obtaining a reliable population size estimate from mark and recapture studies challenging. For example, polar bears of this subpopulation move south with advancing ice during fall and winter and north in advance of receding ice in late spring and early summer (Garner et al. 1990). The most recent estimate of the CBS subpopulation is approximately 2,900 bears (Regehr et al. 2018) based on extrapolation from capture-recapture, radio telemetry and count data. U.S. capture-recapture research conducted in spring of 2008 through 2011 indicated that CBS animals have good body condition and reproduction, suggesting capacity for positive population growth despite sea ice loss (Rode et al., 2014). Regehr et al. (2018) also calculated survival probabilities for Chukchi Sea bears, with survival for adult males and adult females estimated to be 0.89 and 0.90, respectively, and for subadult males and females to be 0.71 and 0.79, respectively.

In the Action Area, the greatest impact to polar bears is loss of sea ice resulting from climate change. Other factors such as subsistence hunting, MMPA authorizations, recreation and research, and environmental contaminants are also discussed in this section.

Climate change and sea ice loss
Global climate change and its effects in the Arctic are likely to have serious consequences for the worldwide population of polar bears and their prey (Amstrup et al. 2007; Amstrup et al. 2008; Hunter et al. 2010; Atwood et al. 2015). The associated reduction of summer Arctic sea ice is expected to be a primary threat to polar bear populations (Stirling and Derocher 2012), and projections indicate continued climate warming at least through the end of this century (IPCC 2013). The Service issued a draft Polar Bear Conservation Management Plan (USFWS 2015b). In it, the Service reaffirms the 2008 ESA-listing decision, that the decline of sea ice habitat due to changing climate, driven primarily by increasing atmospheric concentrations of greenhouse gases, is the primary threat to polar bears.

Climate change is expected to impact polar bears in a variety of ways. The timing of ice formation and breakup will impact seal distributions and abundance, and, consequently, how efficiently polar bears can hunt seals. Reductions in sea ice are expected to increase the polar bears' energetic costs of traveling, as moving through fragmented sea ice and swimming in open water requires more energy than walking across consolidated sea ice (Cherry et al. 2009; Pagano et al. 2012; Rode et al. 2014). Research has linked declines in summer sea ice to reduced physical condition, growth, and survival of polar bears (Bromaghin et al. 2015).

Habitat loss due to declining Arctic sea ice throughout the polar bear's range has been identified as the primary cause of population decline and is expected to continue for the foreseeable future (73 FR 28212). Amstrup et al. (2007) projected a 42 percent loss of optimal summer polar bear habitat by 2050. They concluded that if current Arctic sea-ice declines continue, polar bears may eventually be excluded from onshore denning habitat in the Polar Basin Divergent Region. Amstrup et al. (2007) projected the SBS subpopulation may be extirpated within the next 45–75 years, if sea-ice declines continue at current rates.

The occurrence of polar bears along the Beaufort Sea coast has increased in recent years (Schliebe et al. 2008) in correlation with the distance of pack ice from the coast at that time of year (i.e., more bears are observed onshore when the leading edge of the ice is further offshore; Schliebe et al. 2006). We expect this trend to continue in the future, and surmise that an increasing number of bears onshore for longer periods of time during the open water season may increase the potential for human-bear conflicts industrial development or other human activities. Additionally, in recent years when sea ice has retreated far from the Beaufort Sea coast, researchers have observed polar bears swimming in open water, far from the nearest sea ice or land, presumably placing them at risk of exhaustion (Durner et al. 2011; Pagano et al. 2012). In the fall of 2004, four drowned polar bears were observed in the Beaufort Sea during a BOEM coastal aerial survey program (Monnett and Gleason 2006).

Schliebe et al. (2008) determined that an average of 4.0 percent of the SBS subpopulation of polar bears was on land in autumn during 2000 to 2005, and that the percentage increased when sea ice was farther from the coast. More recently, Atwood et al. (2016) determined that the percentage of radio-collared adult females coming ashore in summer and fall increased from 5.8 to 20 percent between 2000 and 2014. Over the same period, the mean duration of the open-water season increased by 36 days and the mean length of stay on land by polar bears increased by 31 days (Atwood et al. 2016). While on shore, the distribution of polar bears is largely influenced by the opportunity to feed on the remains of subsistence-harvested bowhead whales. Most polar bears are aggregated at three sites along the coast, Utqiaġvik, Cross Island, and Kaktovik (Rogers et al. 2015; McKinney et al. 2017; Wilson et al. 2017).

In addition to increased use of land during the open-water season, polar bears in the SBS subpopulation have also increasingly used land for maternal denning. Olson *et al.* (2017) examined the choice of denning substrate (land compared to sea ice) by adult females between 1985 and 2013 and determined that the frequency of land-based denning increased over time, constituting 34.4 percent of all dens from 1985 to 1995, 54.6 percent from 1996 to 2006, and 55.2 percent from 2007 to 2013. Additionally, the frequency of land denning was directly related to the distance that sea ice retreated from the coast. From 1985 to 1995 and 2007 to 2013, the average distance from the coast to 50 percent sea ice concentration in September (when sea ice extent reaches its annual minimum) increased 351±55 km (218.10±34.17 mi), while the distance to 15 percent sea ice concentration increased by 275±54 km (170.88±33.55 mi). Rode *et al.* (2018) determined that reproductive success was greater for females occupying land-based dens compared to ice-based dens, which may be an additional factor contributing to the increase in land-based denning. However, this increase in the proportion of dens occurring in the terrestrial environment may increase the potential for disturbance at dens from industrial development and other human activities.

Subsistence harvest

The Inuvialuit-Inupiat Polar Bear Management Agreement, a Native-to-Native agreement, between the Inupiat from Alaska and the Inuvialuit in Canada was created for the SBS stock of polar bears in 1988. Polar bears harvested from the communities of Utqiaġvik, Nuiqsut, Kaktovik, Wainwright, and Atqasuk are currently considered part of the SBS stock and thus are subject to the terms of the Inuvialuit-Inupiat Polar Bear Management Agreement. The agreement establishes quotas and recommendations concerning protection of denning females, family groups, and methods of harvest.

In 1988, the Inuvialuit-Inupiat Council (Council) established a sustainable harvest quota of 80 bears for the SBS stock. In 2011, the Council reduced the quota to 70 polar bears. Native subsistence hunters harvested 15 polar bears from the SBS at, or proximal to, Kaktovik between 2008 and 2017 (U.S. Fish and Wildlife Service - Marine Mammals Management Office pers. comm.).

Marine Mammal Protection Act Authorizations: Incidental take and incidental harassment authorizations

The current Beaufort Sea Incidental Take Regulations (ITRs; 81 FR 52318; § 18.128) describe mitigation, monitoring, and reporting requirements of oil and gas operators that are applied to active operations in the central Beaufort Sea which abuts the Action Area to the west. The Beaufort Sea ITRs encompass a larger portion of the range of the SBS stock than the Action Area and have been important in mitigating impacts to polar bears from oil and gas activities on the North Slope to the west of the Program Area. Additional information concerning the USWFS's Incidental Take Program and its demonstrated effectiveness in limiting adverse impacts to polar bears is provided in Section 8 of this document.

Deterrence activities and intentional take authorizations

In addition to the regulatory program allowing for incidental take of polar bears described above, the MMPA also provides a mechanism for managing human-polar bear interactions in order to promote conservation of bears while protecting human safety. This Deterrence Program, under section 101(a)(4)(A) of the MMPA, provides Letters of Authorization (LOAs) that allow the use of deterrence actions to prevent polar bears from damaging private property or endangering personal safety. Under this authority, Federal, State and local government employees may deter polar bears for the welfare of the animal when acting in the course of their official duties, and private persons (such as employees of the oil and gas industry) may enter into cooperative agreements with the Service to carry out deterrence measures when acting in their capacity as designated persons under such an agreement and in full compliance with its terms and conditions. This program strives to: 1) prevent bears from associating food with humans and communities, 2) "condition" bears to avoid humans, human activities and communities, 3) promote movement of bears by actively redirecting them into corridors, such as coastal travel routes, 4) minimize extended use of areas near communities, and 5) minimize bear entry into communities.

Importantly, the program mandates "active deterrence actions must not result in the death or serious injury of any marine mammal," and requires an application that includes: a) a detailed plan of operations, b) a site-specific plan to monitor effects of the activity on polar bears present during activities, and c) a site-specific polar bear interaction plan that outlines steps the applicant will take to limit animal-human interactions, increase site safety, and minimize impacts to polar bears. The program does not allow for the deterrence of polar bears for convenience or to aid project activities, and prior to conducting deterrence activities operators must make reasonable efforts to reduce or eliminate attractants (e.g., garbage, human waste, and food); move personnel to safety; ensure the bear has escape route(s); and begin with the lowest level of force or intensity that is effective and increase the force or intensity only as necessary to achieve the desired result. The program also contains specific training, monitoring, and reporting requirements to minimize risk and impacts to polar bears. This program has been in place for decades, and although deterrence actions result in negative impacts to individual bears on rare occasions, proper implementation of deterrence actions under this program effectively reduces the need for lethal take of polar bears, and thus as a whole contributes to the conservation of polar bears.

For example, between Jan 1, 2001 and Dec. 31, 2016 the entire North Slope oil and gas industry reported 2,731 observations of 4,371 individual polar bears. Of these, 848 (19%) were deterred. Of those deterred, the vast majority were subjected to noise or visual stimuli (e.g., vehicle horns, engine noise, yelling, spotlights, sirens, or discharge of cracker shells) intended to direct bears away from facilities or human activities. On rare occasions, when less-intrusive methods fail, “direct contact” rounds such as bean bags or rubber bullets are used. During 640 deterrence events by industry on the North Slope from Jan 1, 2001 to Dec. 31, 2016, 42 polar bears were hazed with bean bags and 6 with rubber bullets. The number of polar bears hazed with bean bags or rubber bullets annually ranged from 0 to 11; the average was 3 polar bears per year. Injuries or lethal impacts are exceptionally rare. In 2011, a polar bear died because personnel mistakenly used a crackershell to deter a bear at close range rather than a beanbag round (Kimberly Klein, Incidental Take Coordinator, Marine Mammals Management Office, US Fish and Wildlife Service. Pers. Comm.).

Research

Polar bear research takes place within the Program Area as well as throughout the broader Action Area. In general, the long-term goal of research programs is to gain information on the ecology and population dynamics of polar bears to help inform management decisions, especially in light of climate change. These activities may cause short-term disturbance and/or minor injuries (e.g., sedation, tissue sampling, marking, etc.) to individual polar bears targeted in survey and capture efforts, and may incidentally disturb other individuals. In rare cases, research efforts may lead to serious injury or death of polar bears. Polar bear research is authorized through Division of Management Authority (DMA) permits issued under the MMPA. These permits include estimates of the maximum number of bears likely to be impacted by disturbance or minor capture-related injuries, and include a condition to halt research if a specified number of deaths (limited to small numbers), occur during the life of the permit. Research DMA permits are typically issued for a five-year period.

Tourism

As more polar bears are spending time onshore, particularly in areas around the subsistence whale bone pile near Kaktovik there has been an increase in “polar bear viewing” tourism. The influx of visitors to the area may result in increased anthropogenic disturbance of polar bears (e.g., from humans on foot, ATVs, snow machines, or other vehicles). Although difficult to quantify, these disturbances are usually temporary, which may limit the severity of their impact, although the frequency could increase. Land-based viewing is not managed by the

Service, but the Service does manage boat-based viewing. The boat-based viewing program is designed to avoid all impacts to polar bears and not result in any disturbance (USFWS 2019).

Environmental contaminants
Exposure to environmental contaminants may affect polar bear survival or reproduction. Three main types of contaminants in the Arctic are thought to pose the greatest potential threat to polar bears: petroleum hydrocarbons, persistent organic pollutants (POPs), and heavy metals. To date, no large oil spills from oil and gas activities have occurred in marine waters of arctic Alaska. However, contamination of the Arctic and sub-Arctic regions through long-range transport of pollutants has been recognized for over 30 years (Bowes and Jonkel 1975; Proshutinsky and Johnson 2001; Lie et al. 2003). Arctic ecosystems are particularly sensitive to environmental contamination due to 1) the slower rate of breakdown of POPs including organochlorine compounds (OCs), 2) relatively simple food chains, and 3) the presence of long-lived organisms with low rates of reproduction and high lipid levels that favor bioaccumulation and biomagnification. Consistent patterns between OC and mercury contamination and trophic status have been documented in Arctic marine food webs (Braune et al. 2005), and the highest concentrations of persistent organic pollutants in Arctic marine mammals have been found in seal-eating walruses and polar bears near Svalbard (Norstrom et al. 1988; Muir et al. 1999; Andersen et al. 2001). While polar bears may come into contact with contaminants in the Action Area if they are not properly disposed of or secured, this has occurred very rarely. Furthermore, contaminant concentrations are not presently thought to have population-level effects on most polar bear populations. However, increased exposure to contaminants has the potential to operate in concert with other factors, such as nutritional stress from loss or degradation of sea ice habitat, decreased prey availability and accessibility, or lower recruitment and survival rates. These combined stressors could ultimately have negative population level effects on polar bears.

7.4 Baseline of polar bear critical habitat in the Action Area
The Action Area includes portions of each of the three polar bear critical habitat units. Activities proposed under the RFD would primarily occur within terrestrial denning habitat, but areas of overlap with sea ice and barrier island critical habitat would also occur. To date, polar bear critical habitat in the eastern portion of Alaska’s arctic has not been subject to oil and gas development; however, due to Public Law 115-97, future Industry interest in the area is expected to increase.

Localized effects to critical habitat in the Action Area have been small in scale and have been limited to short-term human disturbance from access by scientific researchers as well as recreational and subsistence users. At a larger spatial scale, globally distributed pollutants and climate change have diminished the quality of polar bear critical habitat; however, estimating the magnitude of these effects within the Action Area is difficult. These factors are discussed in further detail below.

Environmental contaminants
Exposure to environmental contaminants may affect polar bear survival or reproduction. Thus, the presence of contaminants within polar bear critical habitat could affect the conservation value of the habitat. Three main types of contaminants in the Arctic are thought to pose the greatest

potential threat to polar bears: petroleum hydrocarbons, persistent organic pollutants (POPs), and heavy metals.

Petroleum hydrocarbon contamination from oil and gas development has had a limited effect on the environmental baseline of polar bear critical habitat. A single large spill has been reported for the Chukchi and Beaufort seas. In August 1988, 68,000 gallons (1,619 barrels) of heating fuel were spilled 3–6 miles north of the barrier islands off Brownlow Point by a barge tanker enroute to Kaktovik. No large oil spills from oil and gas activities have occurred in arctic Alaska. Small spills have occurred but have affected a limited area.

Contamination of the Arctic and sub-Arctic regions through long-range transport of pollutants has been recognized for over 30 years (Bowes and Jonkel 1975, Proshutinsky and Johnson 2001, Lie et al. 2003). Arctic ecosystems are particularly sensitive to environmental contamination due to the slower rate of breakdown of POPs, including organochlorine compounds (OCs), relatively simple food chains, and the presence of long-lived organisms with low rates of reproduction and high lipid levels that favor bioaccumulation and biomagnification. Consistent patterns between OC and mercury contamination and trophic status have been documented in Arctic marine food webs (Braune et al. 2005). Although polar bears in arctic Alaska and designated polar bear critical habitat in Alaska have unquestionably been affected by exposure to environmental contaminants, at this time we have no reason to believe the critical habitat's ability to support polar bears has been affected.

Climate change

Climate change is contributing to the rapid decline of sea ice throughout the arctic, and some of the largest declines are predicted to occur in the Chukchi and southern Beaufort seas (Durner et al. 2009b *in* USFWS 2010a). This directly affects the sea ice PBFs, which provide feeding, breeding, denning, and traveling habitat for polar bears. Decreased quality and quantity of sea ice may increase the importance of barrier island and terrestrial habitat for foraging, denning, and resting. For example, Schliebe et al. (2006) demonstrated an increasing trend in the number of observed polar bears using terrestrial habitats in the fall. Additionally, Fischbach et al. (2007) hypothesized that reduced availability of older, more stable sea ice is contributing to the observed decrease in the proportion of female polar bears denning on sea ice in northern Alaska.

Climate change may also affect the availability and quality of denning habitat on land. Durner et al. (2006) found that 65% of terrestrial dens found in Alaska between 1981 and 2005 were on coastal or island bluffs. These areas are suffering rapid erosion and slope failure as permafrost melts and wave action increases in duration and magnitude. In all areas, dens are constructed in autumn snowdrifts (Durner et al. 2003). Changes in autumn and winter precipitation or wind patterns (Hinzman et al. 2005) could significantly alter the availability and quality of snow drifts for denning.

8. EFFECTS OF THE ACTION ON LISTED SPECIES

This section of the BO provides an analysis of the effects of the action on listed species and critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

8.1 Effects to spectacled eiders

Hypothetical adverse effects to spectacled eiders in the terrestrial environment from the proposed RFD could potentially occur through long-term habitat loss, disturbance from new infrastructure and on-tundra aircraft landings, increased predators, spills, and collisions with structures. Additionally, spectacled eiders in the Marine Transit Route (MTR) could be effected by disturbance, spills, and/or collisions associated with vessels. The likelihood of each of these factors affecting spectacled eiders is evaluated in more detail below.

8.1.1 Effects in the Program Area

Long-term habitat loss – Winter travel

Snow trails, ice roads, and seismic vibroseis could damage tundra vegetation, and indirectly affect nesting habitat for spectacled eiders. However, we would not anticipate significant long-term habitat loss from winter routes associated with the exploration or development phases. Research indicates damage from winter trails occurs on higher, drier sites with little or no damage in wet or moist tundra areas (Pullman et al. 2003) when ice roads or snow trails are used. Jorgenson (1999) found impacts were limited to isolated patches of scuffed high microsites and crushed tussocks. Similarly, Yokel and VerHoef (2014), found disturbance from seismic and ice road activity was greatest in drier, shrubby habitat than in moist habitat. McKendrick (2003) studied several riparian willow areas and found although some branches were damaged, the affected plants survived. Because spectacled eiders prefer to nest in low moist tundra areas (Anderson and Cooper 1994, Anderson et al. 2009), and we anticipate limited damage in these habitats from winter routes associated with the proposed RFD, we conclude these activities are not likely to adversely affect spectacled eiders.

Long-term habitat loss – Gravel placement and extraction

Direct, permanent habitat loss would result from the extraction or placement of gravel fill impacting up to 2,000 acres (8.1 km^2) of wetlands under the proposed RFD. We also anticipate indirect habitat loss via disturbance would occur within a 200 m (656.2 ft.) zone of influence surrounding new development from on-pad activities, road operations, and maintenance activities. The two principal mechanisms through which disturbance can adversely affect eiders on their breeding grounds are:

1. Displacing adults and/or broods from preferred habitats during pre-nesting, nesting, brood rearing, and migration; and
2. Displacing females from nests, exposing eggs or small young to inclement weather and predators.

In the discussion below, we provide an assessment of potential loss of spectacled eider production resulting from estimated impacts to nesting habitat from the RFD.

Effects to nesting spectacled eiders

Broad-scale aerial surveys conducted in multiple years allow us to estimate how density of listed eiders varies across the landscape. These estimates were developed at a coarse regional scale and are not site- or habitat-specific; however, they reasonably reflect the density of breeding spectacled eiders in the Program Area. Observations during aerial surveys of the ACP in 2012–2015 indicate spectacled eider density within the surveyed subset of the Program Area was low, and ranged from 0 to 0.074 spectacled eiders/km^2 (USFWS 2015a), with a mean density of (0.01 spectacled eiders/km^2 or 0.005 nests/km^2; Figure 6.2).

However, because locations of activities associated with the RFD are unknown, and anchor fields could be located anywhere within the Program Area, we adjusted the estimated density of spectacled eiders to reflect average density across the entire Program Area. GIS raster data based on the aerial survey assigned density values (i.e., birds/km^2) using a grid of pixels overlaying the aerial survey area (Figure 6.2). The BLM provided GIS analysis which we adopt here, to incorporate the discrete aerial survey area and extend a theoretical boundary to cover the entire Program Area (Figure 8.1). Pixels outside the discrete aerial survey area were assigned a density of zero as these areas are not surveyed because they contain unsuitable habitat for nesting waterfowl. A mean density estimate of 0.003 spectacled eiders/km^2 for the entire area was calculated using all values contained in all pixels (Figure 8.1). This estimate was then adjusted for imperfect detection by assuming ~75% of spectacled eiders are seen during aerial surveys (Wilson et al. 2017), which resulted in an estimated 0.004 spectacled eiders/km^2. Last, assuming one potential nest for every two adults, we divided estimated density by two to convert the estimate to number of pairs or nests/km^2. Applying this process, we estimate an average density of 0.002 spectacled eider pairs or nests/km^2 in the Action Area.

To estimate impacts of the 2,000 acres of development projected to occur under the RFD plus the associated zones of influence, we estimated the total footprint size (direct impact + zone of influence) for each project feature described in Table 3.1 (i.e., pads for CPF, satellites, STP, barge landing, roads and VSMs). We also assumed:

- The footprint of each pad feature is approximately square;
- Impact areas for pipelines and VSMs would be limited to the directly impacted area, (i.e., there would be no zone of influence because, aside from occasional inspections and winter maintenance, on-going disturbance would not be associated with these features); and,
- The total impact area estimated for a single anchor field (137.6 km^2) should be multiplied by four to account for the four anchor fields proposed under the RFD.

Therefore, we estimate impacts to nesting habitat, including direct habitat loss from excavation or fill and the 200-m zone of influence surrounding development features, to be 31,546 acres or 128 km^2. To estimate the likelihood of eiders occurring within the area of habitat loss, we multiplied the average annual density of spectacled eider breeding pairs in the Action Area (0.002 eiders/km^2) by the size of the impacted area (128 km^2). While acknowledging the imprecision of this calculation and its associated assumptions, this approach estimates a potential loss of 0.3 spectacled eider nests each year, or 35 nests over the projected 135-year Program from long-term habitat loss and associated disturbance.

Disturbance from aircraft landings and on-tundra activities
An absence of empirical data makes it difficult to estimate the effect of aircraft landings and associated ground-based activities (e.g., archeological surveys, stick picking and/or other debris removal) on nesting and brood-rearing listed eiders. Our estimates are therefore based on a series of assumptions. Landing close to a nest would likely flush a female and prevent her from returning for as long as the aircraft and associated human activity remain near the nest. We expect there is a gradient effect centered on a given landing site, with effects presumably decreasing with increasing distance. However, in order to provide a numerical estimate, we assume all hens within a 600-m radius of a landing site would be flushed, and nests would subsequently be at increased risk of abandonment or depredation. The likelihood of a nesting hen flushing, and her reluctance to return to the nest, is assumed to decrease as distance from human activity increases. We assume no effects to nesting hens outside this 600-m radius. We also assume the 600-m radius centered on the landing site would encompass the area affected by associated on-tundra activities. After landing, field crews would conduct work over an unspecified area, and it is assumed all nesting spectacled eiders within the radius of the landing site would be disturbed. While aircraft landings and associated activities may also disturb or fragment hens with broods, we assume these impacts would be minor and temporary because hens with broods are mobile and could move away from disturbance.

Effects of disturbance associated with on-tundra summer aircraft landings, and the on-tundra activities they provide access for, are therefore assumed to result in reduced production of listed eiders, and we estimate effects of hypothetical summer aircraft landings on spectacled eider nesting success by using the following multi-step process:

1) Using the assumptions described above, we estimate potential effects of aircraft and human disturbance on spectacled eider nest success would occur within a 600-m radius, or 1.13 km^2 area, at each landing site, and multiply this area of impact by the total number of sites (for this analysis, we estimated up to 650 landings would occur within the nesting period each year, based on the number of similar aircraft operations that occur in NPR-A in recent years).
2) We then use our assumption regarding distance over which take-off and landing may affect eider nests, combined with estimates of eider density, to estimate the number of nests potentially subject to disturbance.
3) Finally, because not all nests subjected to disturbance would be expected to fail, we multiply the estimated reduction in nest success by the number of nests potentially disturbed, calculated in Step 3, to estimate the total number of nest failures that could result from aircraft activities during exploration and development.

These steps are explained in more detail below.

We assume summer activities in support of exploration and development (years 2 through 85) would include helicopter-based cleanup and site inspections from June through August. Total helicopter landings would vary depending on the number of winter exploration camps, areas of concern, and/or other debris.

The number of spectacled eider nests potentially disturbed near landing sites was estimated by multiplying the area impacted at each site (600-m radius, area of 1.13 km^2) by the number of sites estimated each summer season (650 sites), and the adjusted estimated nest density for spectacled eiders (0.004 spectacled eiders/km^2 or 0.002 nests/km^2) as follows:

1.13 km^2 × 650 sites = 734.5 km^2 affected, 0.002 spectacled eider nests/km^2 × 734.5 km^2 = 1.47 spectacled eider nests potentially disturbed.

Nest success varies spatially and temporally. Using Mayfield methods, Bowman and Stehn (2003) estimated nest survival for spectacled eiders on the YK-Delta in 1994 – 2002 to be 0.678. At Utqiaġvik, Safine estimated spectacled eider nest survival to be 0.27 (95% CI: 0.08 – 0.51) in 2013 and 0.62 (95% CI: 0.28, 0.83) in 2014 (Safine 2015). Therefore, it is clear that not all nests will survive to hatch, and survival rates vary among years and areas.

Furthermore, we would not expect all nests from which females flush to be abandoned or depredated. For example, a site visit including one helicopter landing and human presence lasting 15 minutes would presumably result in lower risk of nest abandonment than a site visit requiring several landings and 8-10 hours of on-tundra activity; however, the difference is difficult to quantify. Bowman and Stehn (2003) and Grand and Flint (1997) reported human disturbance at spectacled eider nests on the YK-Delta reduced nest success by a mean of 9.9% (rounded to 10%). Although the likelihood of nest abandonment or depredation resulting from aircraft landings and on-tundra activities would presumably vary with the number, frequency, and duration of landings, and the type of activities at each site, we assume effects of human disturbance on nest success reported on the YK-Delta would also approximate the effects of aircraft disturbance on spectacled eider nests in the Program Area.

We also assume risk of nest failure where a hen is flushed twice (i.e., a hen is flushed during landing, returns to the nest, and is flushed again during takeoff) would be double (19.8%, which we round to 20%). We expect these circumstances would represent a worst-case-scenario (i.e., most impactful), and calculate annual nests lost to aircraft disturbance in the Program Area as follows:

> 1.47 spectacled eider nests potentially disturbed × 0.20 = 0.297 spectacled eider nests lost due to disturbance.

Using this process we estimate 0.29 spectacled eider nests would be lost each summer season due to on-tundra aircraft landings. Therefore, over the predicted 85-year period of on-going exploration and development, we estimate summer aircraft operations would result in loss of production of 25 spectacled eider nests.

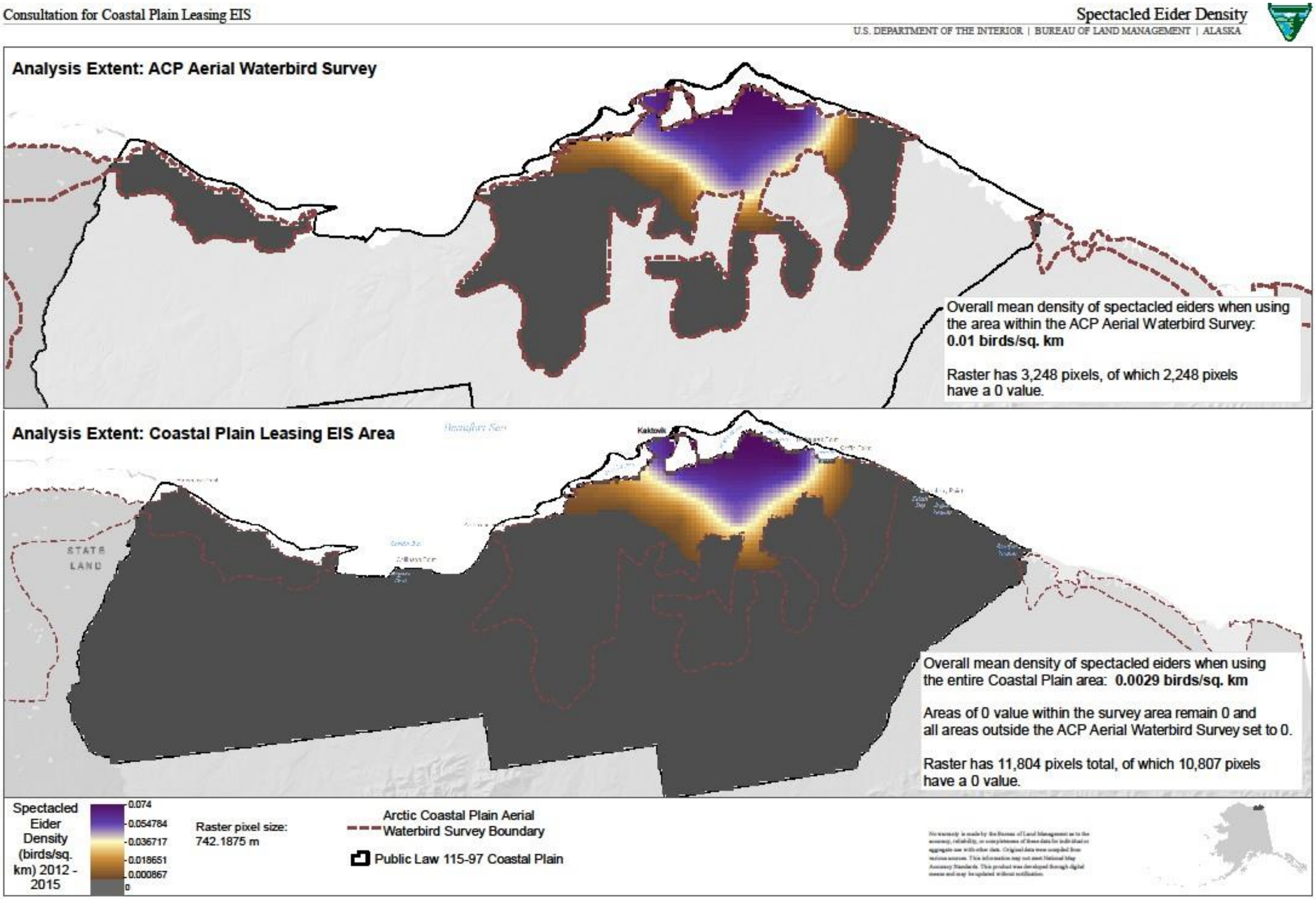

Figure 8.1. Average density of spectacled eiders/km^2 from the ACP aerial survey (top), and extrapolated to the entire project area (bottom).

Increased predators
As discussed in the *Environmental Baseline* for spectacled eiders, abundance of predators and scavengers has increased near industrial infrastructure to the west of the Program Area. In particular, ravens have expanded their breeding range on the ACP by using manmade structures for nesting and perching. Therefore, as the number of structures and anthropogenic attractants associated with development increase, reproductive success of listed eiders may decrease.

Estimating the effects of predators on spectacled eider production in the Program Area is extremely difficult. We expect structures associated with the RFD would increase the number of potential nesting and perching sites for ravens, and increased availability of anthropogenic food sources may also attract predators to the Action Area. However, measures requiring proper waste management and disposal (i.e., ROP 2 in the *Description of the Proposed Action*) would reduce potential increases in predators responding to anthropogenic attractants, and potential subsequent depredation of spectacled eider nests, and thereby diminish adverse effects to spectacled eiders from increased predator populations.

Spills
Accidental spills of oil or other petroleum products resulting from activities during all phases of the RFD could originate from anchor fields (e.g., CPF and satellite pads), terrestrial pipelines, and vessels operating in the Program Area. Exposure to oil may impact spectacled eiders in several ways, depending on the volume, location, and timing of a spill, and severity of exposure. For example, waterfowl directly contacting even small amounts of oil may lose the hydrophobic, insulative properties of their feathers and suffer impaired thermoregulation. These birds may become wet, hypothermic, or potentially drown (Jenssen 1994). Birds sublethaly exposed to oil may also suffer reduced reproductive success. Mortality of embryos and nestlings follows exposure to even small amounts of hydrocarbons (light fuel oil, crude oil, or weathered oil) transferred to eggs or ducklings from adults with lightly oiled plumage (Parnell et al. 1984; Hoffman 1990; Szaro et al. 1980; Stubblefield et al. 1995). Furthermore, waterfowl ingesting oil in the course of normal foraging or preening behaviors may experience toxicological effects including gastrointestinal irritation, pneumonia, dehydration, red blood cell damage, impaired osmoregulation, immune system suppression, hormonal imbalance, inhibited reproduction, retarded growth, and abnormal parental behavior (Albers 2003; Briggs et al. 1997; Epply 1992; Fowler et al. 1995; Hartung and Hunt 1966; Peakall et al. 1982). Birds also bioaccumulate hydrocarbons and are vulnerable to both accute and sublethal effects from contaminated food supplies (Albers 2003).

Although small spills (< 500 bbl) could occur during winter exploration, and year-round development and production activities associated with the RFD, due to measures required by Lease Stipulations 4 and 6, and ROPs 1-3, 21, and 46, spills are expected to be uncommon (BLM 2019). Furthermore, due to low density of spectacled eiders in the Action Area, we expect the likelihood of spectacled eiders encountering oil from a small terrestrial or marine spill in the Program Area would be low. Small spills would be more likely to occur than large spills, and we expect the majority of small spills would occur on production pads, be confined to a small area, and be remediated quickly. Small marine spills (i.e., at the barge landing) would be expected to be contained or weather quickly (i.e., within 24 hours; BLM 2019), and small onshore spills would likely be recovered (e.g., oiled soil or tundra would be removed and disposed of).

Although disturbance of spectacled eiders could occur during spill response efforts, this disturbance is expected to be minor and temporary as eiders would be expected to move away to a safe distance. In their proposed RFD, the BLM did not project any spills >500 bbl, therefore the consequences of a large spill are considered not reasonably certain to occur.

Because 1) spills are expected to be uncommon and of low volume, 2) spectacled eider density in the Program Area is low, 3) small spills are expected to be contained or weather quickly, 4) eiders would likely avoid disturbance associated with areas of active response, and 5) material handling, spill prevention, and response measures required by the BLM through Lease Stipulations and ROPs include numerous measures to minimize impacts to spectacled eiders in the event of a spill; we anticipate the consequences of small oil spills would, at most, impact low numbers of spectacled eiders over the 135 year life of the Program.

Collisions with structures
As discussed in the *Environmental Baseline*, migratory birds are at risk from collisions with human-built structures. Spectacled eiders migrating east during spring and west during summer/fall would be at risk of colliding with structures. These structures include light poles, buildings, drill rigs, and booms. During post-breeding migration in summer and fall, we anticipate male eiders would have the greatest collision risk in the Action Area, as many females remain in the nesting and brood rearing areas. Satellite telemetry studies from the eastern ACP indicated male spectacled eiders depart early in summer and generally remain close to shore, sometimes crossing overland, during westward migration (TERA 2002; see also Petersen et al. 1999). However, we anticipate spectacled eider collision risk with structures from mid-May through late July would be greatly reduced by the visibility of structures during 24 hours of daylight in the project area. When females and juveniles migrate during late summer/fall, decreasing daylight and frequent foggy weather conditions could increase collision risk. Longer nights increase the duration that eiders are vulnerable to collisions with unseen structures, and may compound susceptibility to attraction and disorientation from project lighting. However, we expect collision risk with structures would be reduced by the BLM's ROPs 26 and 27, which require lighting plans that would shield outward-radiating light and minimize potential disorienting and attracting effects to eiders, and communication tower configurations that would reduce collision risk to the extent practicable (e.g., co-location of towers adjacent to structures and avoidance of guys wires).

Overall, we anticipate the likelihood of collisions of spectacled eiders with structures that are part of the proposed RFD would be low because 1) good visibility of project structures in late-spring and early summer due to extended daylight would likely reduce collision risk, 2) facility lighting would be designed to reduce the potential for attracting or disorienting eiders in flight (BLM ROP 26), 3) project features would avoid guy wires to the extent practicable (ROP 27), and 4) spectacled eiders occur at low density in the Action Area. Given the uncertainty in location of structures which may result from the action we have no means to reliably estimate numbers of collisions. However, the estimated collision rate at the Liberty project, located west of the Program Area where large numbers of spectacled eiders occur is one bird over the course of its 25-year lifespan (Service 2018). Therefore, we would anticipate that few (<10) adult or fledged juvenile spectacled eiders could be killed or injured due to collisions with onshore RFD structures over the life of the Proposed Program.

8.1.2 Effects in the MTR

Disturbance from vessels

During development and production phases of the RFD, barges could encounter and disturb spectacled eiders within the MTR. However, because only two barges associated with the RFD would be operating at any given time, we expect barges would encounter very few individuals. We would also expect disturbance from barging operations to be minor and temporary because 1) barges would move slowly through the MTR, and 2) spectacled eiders can respond to vessel disturbance by moving away to a safe distance. Because disturbance to non-breeding, migrating, or marine foraging spectacled eiders would be so minor that injury or death is not expected, effects of vessel disturbance on these individuals would be insignificant.

Spills

BLM (2019) expects that accidental petroleum spills during sealift operations would be limited to small spills originating from vessels, and would most likely occur during fuel transfers. Spectacled eiders in the MTR could conceivably be impacted by unintentional fuel spills during barge re-fueling. However, the BLM has indicated spills during refueling operations would be uncommon, and any spills that take place would be small in size (<500 bbl), and be quickly contained and remediated (BLM 2019). Therefore we anticipate impacts to spectacled eiders from small refueling spills would be very limited in scale. Furthermore, because large spills (>500 bbl) resulting from the limited barging operations would be extremely unlikely, impacts from large spills on spectacled eiders in the MTR are not reasonably certain to occur.

Collisions with vessels

In addition to collisions with onshore structures in the Program Area, spectacled eiders migrating east during spring and west during summer/fall would be at risk of colliding with vessels in the MTR. Using the best available information, we provide an estimate of collision risk for spectacled eiders from barge traffic under the RFD. We first calculated the risk of collision per vessel operating during a single season in the Chukchi and Beaufort seas, based on observed eider (king and common) collisions during Royal Dutch Shell's (Shell) 2012 Exploratory Program, and the estimated number of eiders migrating through the region. We then multiplied the estimated collision rate (collisions per vessel per season) by the estimated abundance of spectacled eiders within the Action Area. Next we approximated the number of collisions expected for spectacled eiders for an estimated total of 270[9] vessels, over the life of the Program. Finally, because barges could operate over a longer period each season than the duration of Shell's 2012 open-water campaign, we adjusted the calculations to estimate collisions over an extended operations period (approximately 150-days[10] of predicted open-water barging operations per season). These calculations are presented in detail in Appendix A.

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[9] BLM predicts an average of two barge transports per year (BLM 2018a). Therefore, over a 135-year Program, approximately 270 vessel trips would be expected.

[10] A typical open-water season is approximately 150 days. We expect the proposed barging operations would be of shorter duration (likely much shorter) than the length of a typical open-water season. We also acknowledge the timing of barge operations would be difficult to estimate with precision due to a number of factors including seasonal variation in sea ice conditions and marine forecasts. Therefore, lacking greater certainty in project timing, we have conservatively extrapolated our estimate to cover a full open-water season. We believe this represents an overestimation of collision risk to listed eiders and we expect actual collision risk to listed eiders may be considerably less than the level predicted.

Using the approach described above, we roughly estimate the loss of 12 adults and/or fledged juvenile spectacled eiders from collisions with barges during the proposed RFD. The reliability of these estimates may be limited by several factors. For example, 1) collisions are often episodic, and those resulting from light attraction in inclement weather may be particularly so, such that observations collected on a few structures/vessels in a single year may not be representative of collisions in general, 2) monitoring for collisions is difficult and an unknown number of collisions may go undetected, even by trained bird observers, and 3) low visibility often coincides with increased collisions (Ronconi et al. 2015), which may increase the number of undetected collisions. However, these estimates are based on the best information available.

Summary

In summary, appreciable adverse effects to spectacled eiders from increased predator populations are not anticipated. However, hypothetical adverse effects to spectacled eiders could occur through habitat loss, on-tundra disturbance, oil spills, and collisions resulting from the RFD. Over the 135-year Program, we roughly estimate:

- Loss of production from 35 nests due to long-term habitat loss and associated disturbance;
- Loss of production from 25 nests from on-tundra aircraft operations; and,
- Loss of a total of 17 adult or fledged juvenile spectacled eiders from collisions attributed to the RFD (5 due to collisions with structures and 12 due to collisions with vessels).

Because the most recent population estimate for North Slope-breeding spectacled eiders is 14,814 (13,501–16,128, 90% CI; Stehn et al. 2013), we would not anticipate population level effects from loss of production of 60 total nests, and 17 spectacled eider adults and/or fledged juveniles over the 135-year life of the Proposed Program.

8.2 Effects to spectacled eider critical habitat

We designated critical habitat for spectacled eiders on March 8, 2001 (66 FR 9145). Terrestrial critical habitat occurs on the YK-Delta and marine critical habitat occurs in eastern Norton Sound, Ledyard Bay (both are molting areas), and south of Saint Lawrence Island (the wintering area). We anticipate barging operations or other activities under the RFD would have no effect on terrestrial critical habitat for spectacled eiders. Primary constituent elements (PCEs) of eastern Norton Sound and LBCHU include marine waters greater than 5 m (16.4 ft) and less than or equal to 25 m (82.0 ft) in depth at mean lower low water (MLLW), along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. PCEs of critical habitat south of St. Lawrence Island include marine waters less than or equal to 75 m (246.1 ft) in depth, along with the associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community (66 FR 9146).

Although barges associated with the RFD would follow established marine transit routes that ordinarily avoid critical habitat, because the MTR passes adjacent to LBCHU, barges could conceivably enter this unit during inclement weather or other emergencies. However, we expect these instances would be rare. Furthermore, temporal overlap between vessel traffic and large concentrations of eiders within the LBCHU would be minimized by ROP 46 which would require operators to follow Service guidance when transiting through LBCHU or any other designated critical habitat for listed eiders (BLM 2019). In addition, given the size of LBCHU and the relatively small number of vessels that could operate within it at any one time, we do not anticipate barge traffic during the development or production phases would appreciably affect spectacled eider access to, or use of, LBCHU such that the function and conservation value of the LBCHU for spectacled eiders would be reduced.

Accidental fuel spills during sealift operations would be limited to small spills originating from vessels, and would most likely occur during fuel transfers (BLM 2019). Wintering habitat south of St. Lawrence Island, the nearest critical habitat unit to Dutch Harbor, is 800 km away. Therefore, it is extremely unlikely that any oil from re-fueling spills would be carried into designated critical habitat, and we do not anticipate adverse impacts to spectacled eider critical habitat from refueling spills.

Because 1) impacts to terrestrial critical habitat from the RFD are not expected, 2) overlap between barge traffic, and subsequent disturbance to designated marine critical habitat, is expected to be infrequent and limited to minor short-term disturbance, 3) BLM's ROP would reduce impacts if vessels enter marine critical habitat, and 4) due to geographic separation, impacts from re-fueling spills are not anticipated; cumulative impacts from the Proposed Program are expected to be insignificant. Therefore, we conclude the proposed action is *not likely to adversely affect* designated spectacled eider critical habitat.

8.3 Effects to Steller's eiders

Hypothetical adverse effects to Alaska-breeding Steller's eiders from the proposed RFD could occur through long-term habitat loss, disturbance from new infrastructure and on-tundra aircraft landings, increased predators, and collisions with structures. Additionally, Steller's eiders in the MTR could be affected by disturbance, fuel spills, and/or collisions with vessels.

8.3.1 Effects in the Program Area

Long-term habitat loss, disturbance, increased predators, and collisions with structures

As described in the *Status of the Species*, Steller's eiders in Alaska breed almost exclusively on the ACP, migrating to the breeding grounds in late spring with some individuals remaining in the region as late as mid-October. However, nesting is concentrated in tundra wetlands near Utqiaġvik and Steller's eiders occur at extremely low density elsewhere on the ACP (Figure 8.2). USFWS aerial surveys for breeding eiders conducted annually on the ACP from 1992–2010 reported only 5 observations of Steller's eiders east of the Colville River, with the most recent observation in 1998 (USFWS Alaska Region Migratory Bird Management, unpublished data). Because available data indicate Steller's eiders are extremely unlikely to nest within the Program Area (USFWS 2015a), impacts to nesting Steller's eiders from long-term habitat loss, disturbance from on-tundra aircraft landings, increased predators, and collisions with onshore structures associated with the RFD are not expected.

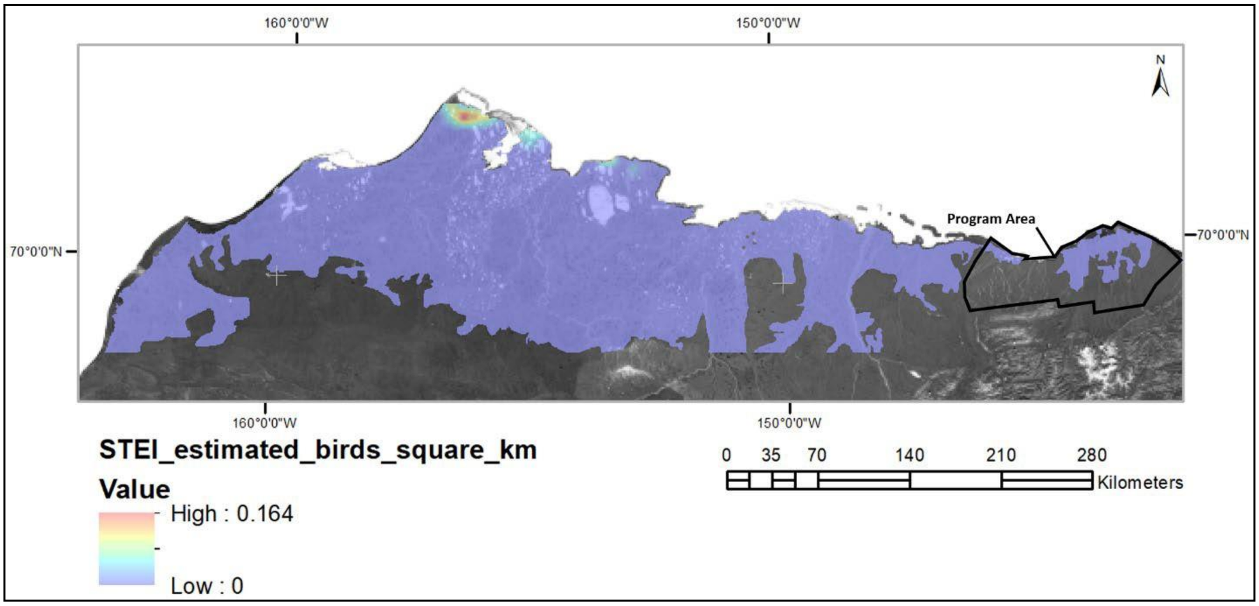

Figure 8.2. Density distribution of Alaska-breeding Steller's eiders observed on the North Slope, including the Program Area, during breeding pair surveys in June, 2012 – 2015 (USFWS 2015a). Colored pixels indicate the aerial survey area. Gray areas are not surveyed because the habitat unsuitable for nesting waterfowl.

Although unlikely, small numbers of non-breeding Steller's eiders could conceivably pass through the Program Area, and if so, could potentially be subject to disturbance from summer activities proposed in the RFD (e.g., development and/or production activities, or on-tundra aircraft landings). However, we expect disturbance to non-breeding eiders would be minor because non-nesting individuals can respond to human presence or disturbance by moving away to a safe distance. Because disturbance would be so minor that injury or death is not expected, effects of disturbance from summer activities to non-breeding Steller's eiders in the Program Area would be insignificant.

8.3.2 Effects in the MTR

Disturbance from vessels

During development and production phases of the RFD, barges could encounter and disturb Steller's eiders within the MTR. However, only two barges associated with the RFD would be operating at any given time, and because Steller's eider density is relatively low throughout the MTR, we expect barges would encounter very few individuals. We would also expect disturbance from barging operations to be minor and temporary because 1) barges would move slowly through the MTR, and 2) Steller's eiders can respond to vessel presence or disturbance by moving away to a safe distance. Because disturbance to non-breeding, migrating, or marine foraging Steller's eiders would be so minor that injury or death is not expected, effects of vessel disturbance on these individuals would be insignificant.

Spills

Accidental fuel spills during sealift operations would be limited to small spills originating from vessels, and would most likely occur during fuel transfers (BLM 2018a). Steller's eiders in and around Unalaska Island could conceivably be impacted these spills during barge re-fueling operations in Dutch Harbor. However, because Steller's eider would only be present near Unalaska Island during winter months and barging would take place during the open-water season, temporal overlap between wintering Steller's eiders and barge refueling operations would be unlikely. Furthermore, the BLM's analysis suggested spills during refueling operations would be uncommon, and any spills that take place would be small in size (<500 bbl), and be quickly contained and remediated (BLM 2019). Large spills (≥ 500 bbl) are not anticipated. Therefore we anticipate impacts to Steller's eiders from refueling spills would be insignificant.

Collisions with vessels
Steller's eiders migrating east during spring and west during summer/fall would be at risk of colliding with vessels in the MTR. Collision risk for migratory sea ducks is discussed in greater detail in the *Environmental Baseline*, however we provide a brief discussion regarding collision risk for Steller's eiders below.

Using the best available information, we provide an estimate of collision risk for Steller's eiders from barge traffic under the RFD. We begin by calculating the risk of collision per vessel operating during a single season in the Chukchi and Beaufort seas, based on observed eider (king and common) collisions during Royal Dutch Shell's (Shell) 2012 Exploratory Program, and the estimated number of eiders migrating through the region. We then multiply the estimated collision rate (collisions per vessel per season) by the estimated abundance of Steller's eiders within the Action Area. Next we approximate the number of collisions expected for Steller's eiders for an estimated total of 270 vessels, over the life of the Program. Finally, because barges could operate over a longer period each season than the duration of Shell's 2012 open-water campaign, we adjust the calculations to estimate collisions over an extended operations period (approximately 150-days of predicted open-water barging operations per season). These calculations are presented in detail in Appendix A.

Using the approach described above, we roughly estimate the loss of 1 adults and/or fledged juvenile Steller's eider from collisions with barges during the proposed RFD. The reliability of this estimate may be limited by several biases. For example, 1) collisions are often episodic, and those resulting from light attraction in inclement weather may be particularly so, such that observations collected on a few vessels in a single year may not be representative of collisions in general, 2) monitoring for collisions is difficult and an unknown number of collisions may go undetected, even by trained bird observers, and 3) low visibility often coincides with increased collisions (Ronconi et al. 2015), which may increase the number of undetected collisions. However, this estimate is based on the best information available.

In summary, 1) appreciable effects from long-term habitat loss on nesting Steller's eiders are not expected, 2) effects of disturbance from vessel traffic to non-breeding or migrating eiders would be minor and temporary, and 3) adverse effects from small refueling spills would be unlikely, and large spills are not reasonably expected to occur. However, we estimate the loss of one adult or fledged juvenile Steller's eider due to collision with vessels over the 135-year life of the Proposed Program.

8.4 Effects to Steller's eider critical habitat

The Service designated critical habitat for the Alaska-breeding population of Steller's eiders on March 5, 2001 (66 FR 8850). Terrestrial critical habitat occurs on the YK-Delta (which is not within the Action Area) and marine critical habitat occurs in nearshore waters at Kuskokwim Shoals, Seal Islands, and Nelson and Izembek lagoons. PCEs of these marine critical habitat units for Steller's eiders include marine waters up to 9 m (30 ft) deep and the underlying substrate, the associated invertebrate fauna in the water column, and the underlying marine benthic community (66 FR 8850).

Barge traffic is expected to follow established shipping routes and, because designated critical habitat is geographically removed from the MTR, even in cases of inclement weather or emergencies, it would be unlikely for barges to enter marine critical habitat units for Steller's eiders. Therefore, we anticipate impacts of vessel presence on Steller's eider marine critical would be insignificant.

Accidental fuel spills during sealift operations are anticipated to be limited to small spills originating from vessels, and would most likely occur during fuel transfers (BLM 2018a). Izembek Lagoon, the nearest critical habitat unit to Dutch Harbor, is 250 km away. Therefore, it is extremely unlikely that any oil from infrequent small re-fueling spills would be carried into designated critical habitat. Furthermore, the BLM has indicated any spills that take place during refueling operations would be quickly contained and remediated (BLM 2019). Therefore we anticipate impacts to Steller's eider critical habitat from refueling spills would be insignificant.

Because 1) impacts to terrestrial critical habitat from the RFD are not expected, 2) overlap between barge traffic and designated marine critical habitat is not expected, and 3) due to geographic separation, impacts from infrequent, small re-fueling spills are not anticipated; impacts from the proposed Program to Steller's eider critical habitat are expected to be insignificant. Therefore, the proposed action is *not likely to adversely affect* designated Steller's eider critical habitat.

8.5 Effects to Polar Bears

In this section we evaluate potential effects of the proposed action to polar bears. First, we review how polar bears use the Coastal Plain of Arctic Refuge, dividing the discussion between denning and non-denning bears. We use this approach because they occur at different times of the year, involve different members of the population; and because denning polar bears are more sensitive to disturbance, and are less capable of moving away from disturbance or other impacts. In our review, we highlight distribution and timing of use by bears, which is useful in considering potential exposure to impacts caused by industry activities. Second, we briefly review the anticipated activities of industry (i.e., the RFD, referring the reader back to *Project Description*, above, and the BA for more detail). Here, too, we highlight location and seasonal timing, again to help describe potential exposure or intersect between the activities of polar bears and industry. We then review factors that would serve to increase or decrease potential impacts, including characteristics of the proposed Program and/or other existing regulatory programs. Last, we identify and discuss the potential mechanisms of impact to polar bears, which include disturbance, human-polar bear interactions, and exposure to spilled oil or other contaminants.

8.5.1 Polar Bear Use of the Coastal Plain of Arctic Refuge

Maternal Denning

Polar bears breed on sea ice from March to June, peaking in early April through mid-May (Schliebe et al. 2006). Pregnant females later move from areas and habitats occupied in late summer and autumn, which are generally on pack ice but increasingly on shore as sea ice conditions in late summer deteriorate (Rode et al. 2015), to prospect for den sites in suitable denning habitat in late October or early November (Derocher et al. 2004). Females excavate a den in drifted snow in fall or early winter (Amstrup and Gardner 1994), enter the den in late November, give birth in late December, and emerge in late March or April (Ramsay and Stirling 1988). After emerging from dens, most females with cubs remain near dens (within 100 m; Smith et al. 2007) for several days [range 1 – 18 days (Streever and Bishop 2014); mean 6 to 8 days (Smith et al. 2007] before permanently abandoning the den site.

Polar bears from the SBS subpopulation den on drifting pack ice, shorefast ice, and land (Amstrup and Gardner 1994), although only terrestrial dens, which can occur on barrier islands, along the coast, or inland, would occur within the Action Area (Figure 8.3). Key characteristics of maternal denning habitat are surface anomalies or topographic features that collect drifting snow in autumn and early winter, as dens require snow accumulations at least 1.5 m deep (Liston et al. 2015). Terrestrial dens occur on barrier islands and on the lee side of coastal bluffs and banks lining rivers, streams or lakes (Amstrup and Gardner 1994; Durner et al. 2001, 2003, 2006; Fischbach et al. 2007; summarized by USFWS 2010 and USFWS 2016).

Historical records of polar bear den sites provide insight into the characteristics of suitable denning habitat, the distribution and extent of suitable habitat, the distribution of known den sites, and the number of dens estimated to occur in the Program Area. Durner et al. (2001, 2003) identified characteristic habitat features of terrestrial maternal den sites and Durner et al. (2006) used high-resolution aerial photographs to inventory and map suitable denning habitat within Arctic Refuge.

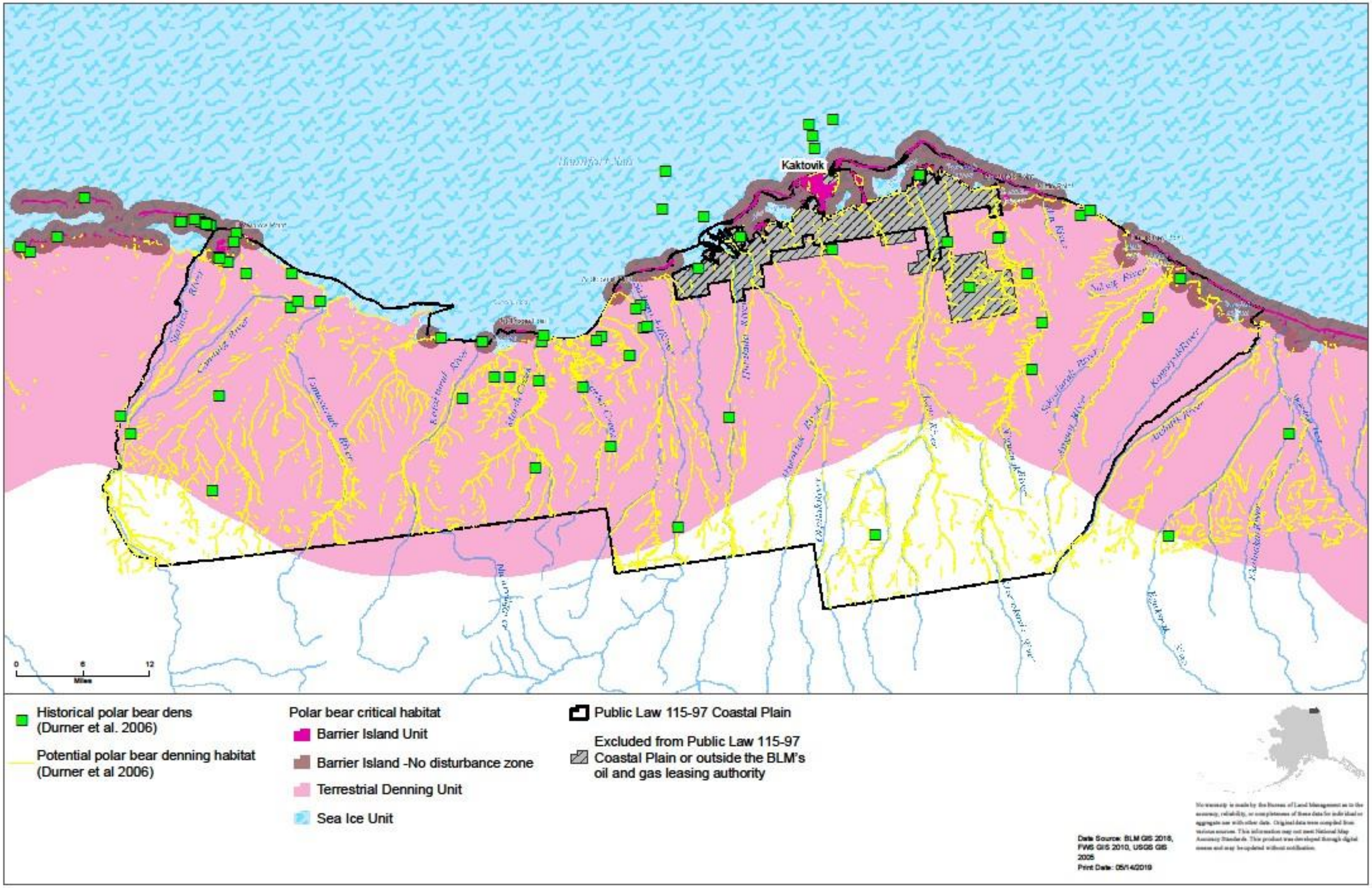

Figure 8.3. Historical polar bear dens (green), potential polar bear denning habitat (yellow), and polar bear critical habitat (pink) within the Coastal Plain of Arctic Refuge.

As elsewhere on the ACP, terrestrial den sites in Arctic Refuge occur on barrier islands and bluffs along the coast, river and stream banks, and lakeshores. Terrestrial habitat with features suitable for denning is broadly distributed, yet also relatively scarce on the landscape. Within the Coastal Plain of Arctic Refuge, suitable denning habitat was found to occur along 1,769 linear miles of banks (BLM 2019, based on Durner et al. 2001, 2006), with an area of 4,600 acres (assuming an average width of 21 feet, following Durner et al. 2001), which comprises less than 0.3 percent of the total area.

Historical records of polar bear den sites include dens found by several means, including targeted den searches, dens found incidentally during other human activities, and radio tracking of collared female polar bears. Because targeted den searches and incidental observations can overemphasize den sites near villages or industrial sites, and underemphasize dens in more remote areas, dens found by tracking females wearing radio collars, particularly those tracked by satellites, reduce or avoid biases associated with dens found opportunistically. Two maps (developed at different scales) based on den locations found by tracking females with radio collars illustrate the variation in density of terrestrial den sites across the landscape. Across the ACP, terrestrial den sites used by females from the SBS subpopulation have occurred disproportionately to the east, including within Arctic Refuge (Figure 8.4[11]). Within the Coastal Plain of Arctic Refuge, den density has been notably higher in two areas: 1) near the northwest corner of the Program Area, overlapping significantly with the Canning River Delta; and 2) in a broad area south of Camden Bay (Figure 8.5). Maternal dens have occurred in moderate density in a third area, in the eastern half of the Program Area, near and along several drainages including the Niguanak River (Figure 8.5).

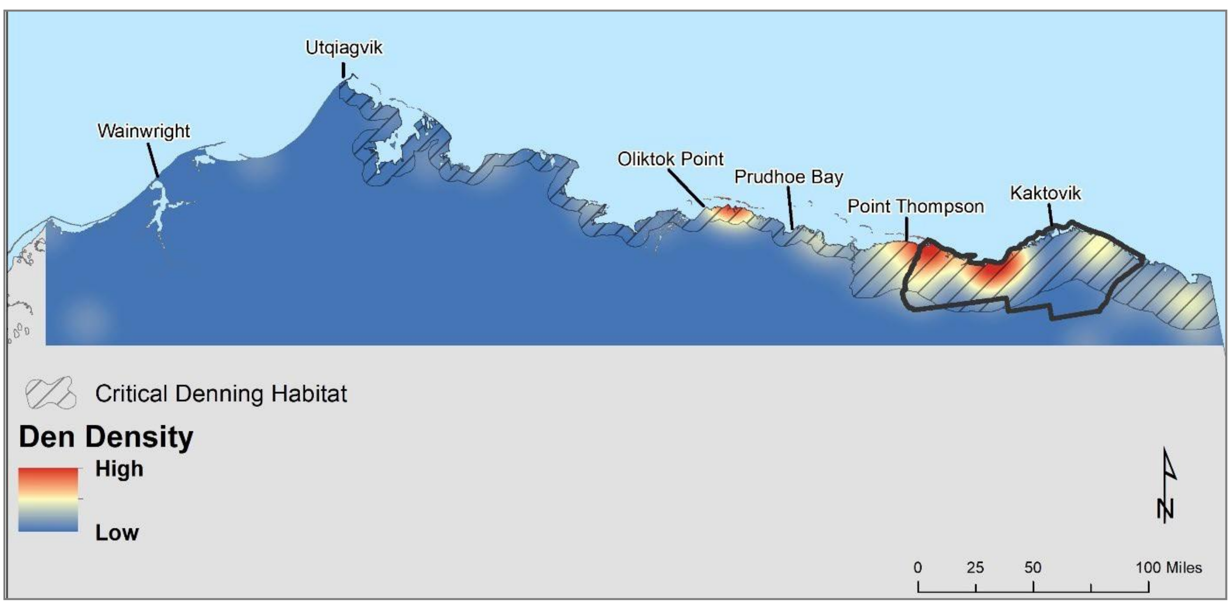

Figure 8.4. Relative density of polar bear maternal dens on the North Slope of Alaska.

[11] Figures 8.4 and 8.5 are density kernel maps developed Service and U.S. Geologic Survey scientists using Program R (R Core Development Team 2017) based on 33 den locations discovered by tracking VHF-radio telemetery and GPS collared females (den sites from Durner et al. 2010; G. Durner unpublished data).

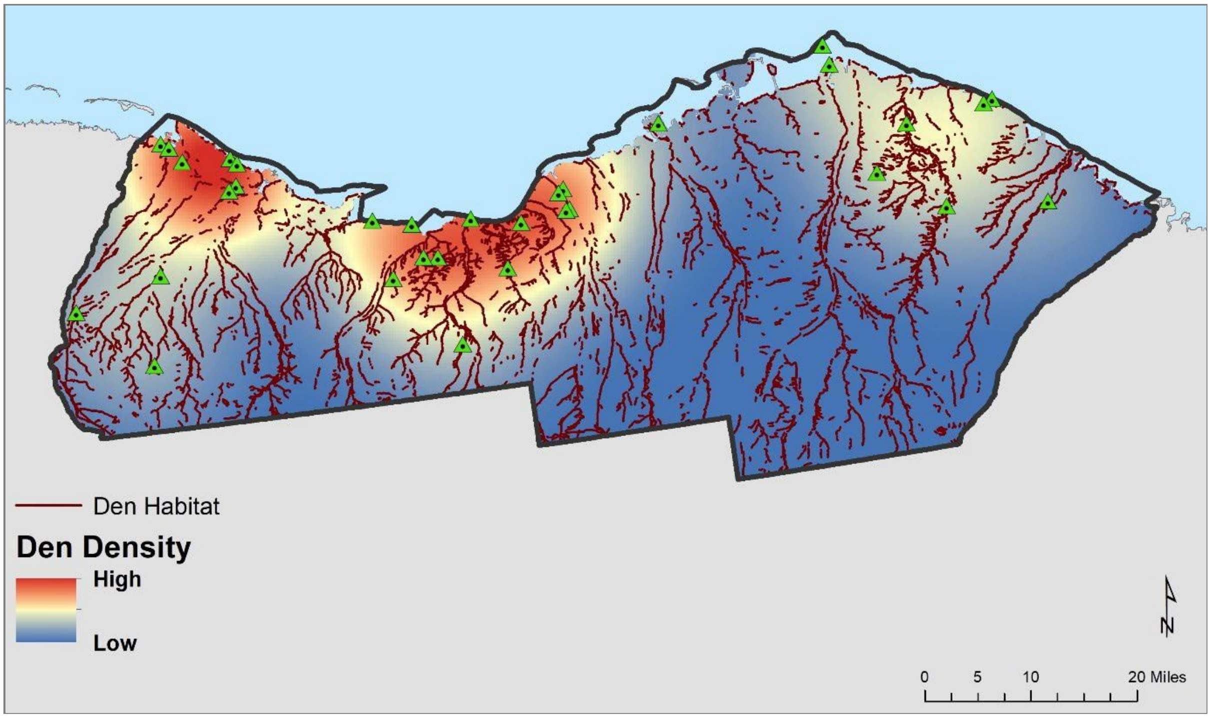

Figure 8.5. Relative density of polar bear maternal dens and suitable denning habitat within the Coastal Plain of Arctic Refuge.

Service scientists recently estimated the number of maternal polar bears occurring on the Coastal Plain of Arctic Refuge using a multi-step process (Service unpublished data). Olson et al. (2017), using radio collar data from 2007 – 2013, found that 55% (16 of 29) of females from the SBS subpopulation denned on land. Of dens from the SBS subpopulation that occurred on land, 23% (9 of 39 dens located with satellite collars in 2000 – 2010) were within the Coastal Plain of Arctic Refuge. Combining these estimates with a recent estimate of abundance of the SBS subpopulation (900 bears; Bromaghin et al. 2015), the proportion of adult females within the population (0.351; Regehr et al. 2010), and the proportion of adult females breeding (0.482; derived from Regehr et al. 2010), Service scientists estimate approximately 19 terrestrial maternal dens occur in the Coastal Plain of Arctic Refuge each year (USFWS unpubl. data).

Recent observations indicate the distribution of maternal dens in the Beaufort Sea region is shifting, from west to east on sea ice, and landward, from sea ice to onshore areas, in response to decreasing quality and stability of sea ice as arctic regions warm (Fischbach et al. 2007). As these trends continue, in the long-term it may become increasingly difficult for females to access terrestrial denning habitat in autumn and early winter as the distance between pack ice and coastal areas increases (Derocher et al. 2004; USFWS 2016; Olson et al. 2017). Continuing changes in sea ice will likely affect the future distribution of dens. However, the number or proportion of denning polar bears in the Coastal Plain of Arctic Refuge will likely increase unless or until the widening distance between the edge of pack ice and land reduces access to terrestrial denning habitat (Derocher et al. 2004; Rode et al. 2015; USFWS 2016).

Non-denning polar bears

Polar bears of the SBS subpopulation historically spent the majority of the year on sea ice (Amstrup 2000; Atwood et al. 2016). Amstrup (2000) noted that for the Chukchi and Beaufort sea areas of Alaska and northwest Canada, less than 10 percent of radio relocations were on land, the majority of which were females occupying maternal dens during winter. However, polar bears also use terrestrial habitat on the ACP during late summer and fall, particularly where and when sea ice conditions are poor. Schliebe et al. (2008) reporting on weekly aerial surveys of the coast between Utqiaġvik and the Canada border in September – October of 2000 – 2005, noted up to 8.6 bears/100 km or 122 polar bears total. Relative to estimates of the number in the SBS subpopulation at that time, Schliebe et al. (2008) estimated that an average of 3.7 percent (up to a maximum of 8 percent) of polar bears in the SBS subpopulation occurred along the coast of Alaska. The number observed when ice was farther from the coast, suggested continuing deterioration in sea ice conditions will result in increased use of terrestrial habitat in late summer and fall. Density was over six times higher in areas where subsistence-hunted whale carcasses were available, with the highest number (69% of total bears onshore) near Kaktovik, Cross Island, and near Utqiaġvik (Schliebe et al. 2008). Wilson et al. (2017), analyzed results from the same surveys but included later years and a longer interval (2000 – 2014), and reported the mean number of bears onshore was 140 (95% CI 127-157). As in earlier years, polar bears were concentrated near Kaktovik, with 63.8% of observations (95% CI 58.4 – 68.9%) on or adjacent to Barter Island, and 25.1% of observations (95% CI 14.4 – 38.8%) near Cross Island. Bears were more likely to occur in coastal areas with early ice retreat, whale carcasses, and barrier islands. Comparing counts to estimates of population size, Wilson et al. (2017) estimated about 15% of the SBS subpopulation occurred along the Alaska coastline during any given week between late Aug and late October. There was no trend in the number of bears using the coast but the highest number occurred in 2012, corresponding to the year with lowest sea ice extent.

Atwood et al. (2016) also examined use of the Beaufort Sea coast by polar bears in late summer and fall in the same interval (2000 – 2014) but using information from radio-collared female polar bears. They found a marked decline in sea ice during September in the southern Beaufort Sea and the average duration of the open-water season increased by 36 days. Although most individuals remained on sea ice during summer, the proportion of the population coming ashore tripled, from 5.8 to 20 percent in 15 years (with a high of 37 percent in 2013). Bears that came ashore did so earlier (5 days/decade on average), departed later (7days/decade on average) and stayed longer (7days/decade on average), and these changes related to declines in sea ice extent and changes in sea ice phenology. Including radio-tracking information from the late 1990s, when use of terrestrial habitat during open-water season was rare and limited to short intervals, the average time bears stayed on land increased by 31 days (Atwood et al. 2016). Importantly, Atwood et al. (2016), using radio telemetry data, found an increase in the *proportion* of the SBS subpopulation coming ashore, although Wilson et al. (2017), using counts in the same area in the same time interval, did not detect an increase in the *absolute number* along the shore. Multiple possible explanations exist, but Wilson et al. (2017) concluded that no detectable trend in the number counted comports with an increasingly larger proportion of a subpopulation (as found by Atwood et al. 2016) that was declining in abundance (from approximately 1,500 in 2004 to 900 in 2010, as found by Bromaghin et al. 2015).

Polar bears of the SBS subpopulation are also increasingly being found on-shore in winter, possibly in response to greater numbers of bowhead whale carcasses being left on-shore after autumn subsistence hunts. Herreman and Peacock (2013) used genetic mark-recapture methods near Utqiaġvik to document use, turnover, and the number, age, and sex of polar bears visiting carcasses, and estimated that 228 individual bears fed at the bone pile in the winter of 2010 – 2011 (November to February), possibly representing up to 15 percent or more of the SBS subpopulation. Extending their observations made near Utqiaġvik to bone piles elsewhere on the North Slope (i.e., Cross and Barter islands) Herreman and Peacock (2013) observed that increasing food subsidies from subsistence harvest remains may benefit polar bears but could also increase the risk of polar bears being killed in defense of life by hunters, residents, tourists, or industry workers.

8.5.2 Industry Activities

To facilitate analysis of effects from the Proposed Program, the BLM provided a hypothetical RFD based on Alternative B. Also relevant to potential effects are the associated Lease Notices, lease stipulations, and Required Operating Procedures that are incorporated into the BLM's Proposed Program. The RFD and associated provisions are discussed in detail in the *Project Description*, above, but a brief summary as it relates to effects to polar bears is provided here.

Phase 1 – Exploration

Exploration would include seismic surveys, exploratory drilling, and the development and use of temporary winter routes and support facilities. Seismic surveys would be conducted during winter using survey vehicles accompanied by mobile camps, which would be pulled by bulldozers or other tracked vehicles and would provide accommodations for survey personnel. The BLM predicts an area-wide 3D seismic exploration within the next two years, with additional lease-level seismic surveys likely to follow within three years after the first lease sale. Compared to other oil and gas activities, seismic surveys would likely be extensive in scale but short-term in duration.

Exploratory drilling would occur during winter from temporary ice pads; additional delineation wells could be drilled nearby in subsequent winters if encouraging results were found. After drilling and evaluation were completed, wells would be temporarily suspended for future use in production, or plugged and abandoned.

Seismic and exploratory activities would be supported by the construction and use of ice roads, packed snow trails, and aircraft, and temporary camps would provide for personnel. The location of exploratory and delineation wells are unknown, as are the routes of ice roads and snow trails to be used to connect exploration sites to existing developed areas, such as Point Thomson or Kaktovik, or future staging pads established along the coast. Seismic surveys, exploratory drilling, and the construction and use of winter routes would generally take place in winter, which would overlap with the maternal denning period for polar bears.

Phase 2 – Development

Development would include construction of production and support facilities that could occupy up to 2,000 acres of Federal lands within the Program Area. Facilities anticipated include up to four anchor fields, each of which would occupy an anchor pad of about 50 acres that would contain one CPF, an airstrip, storage tanks, a communications center, waste treatment unit, and worker camp. Each CPF would support approximately 4 satellite pads (estimated 14 total), each of which would contain about 30 production wells and occupy about 12 acres. A seawater treatment plant could be constructed along the coast to provide saline water for various production functions.

The plant, if needed, would be expected to occupy about 15 acres and require a gravel access road and pipelines to CPFs. It is estimated that approximately 174 miles of gravel roads would be built to connect these facilities, and it is expected that the gravel would be extracted from multiple material sites throughout the Program Area. Heavy equipment and materials needed for development are likely to be transported from Dutch Harbor by barge during the open-water season (currently July – October) to a barge landing on the coast of the Coastal Plain of Arctic Refuge, which would occupy ~ 10 acres. Transport of materials in marine waters would occur along an established shipping route.

The locations of CPFs, satellite pads, and other infrastructure are currently unknown but would be refined over time as results of seismic surveys and exploratory wells become available. The ultimate locations of facilities would also be partially constrained by lease stipulations and ROPs.

Phase 3 – Production
Following construction of gravel infrastructure, facility construction and production drilling would begin. Each anchor pad would contain a CPF, generator, storage tanks, communications center, waste treatment units, and maintenance shop. Satellite (production) pads would contain about 30 wells, with about 8 drilled per year. Drilling could take place on multiple pads at once, depending on availability of drill rigs. Pipelines would connect satellite pads to the nearest CPF and each CPF would be connected by pipeline to the TAPS pipeline. Approximately 212 miles of pipeline, impacting up to 8 acres, are expected to be needed in the Program Area. Field production would be expected to last up to 50 years before abandonment.

Phase 4 – Abandonment and Reclamation
During decommissioning and abandonment, well casings would be cut off below grade, plugged, and buried. All equipment, facilities, solid waste, pipelines and VSMs would be removed. Gravel would be moved for use elsewhere or returned to mine sites.

Hypothetical Schedule
General timeframes over which Phases 1 – 4 would occur were estimated, with exploration, development, and production potentially persisting for up to 85 years, with abandonment and reclamation potentially occurring until up to 130 years after the ROD.

8.5.3 Factors Serving to Minimize Effects

Protections Inherent in the Project Description
The EIS presents several alternatives and multiple potential combinations of protective measures from which final decisions could be made in the final Record of Decision (BLM 2019). For the purposes of this BO, however, we evaluated potential impacts of the RFD under Alternative B, with its associated lease stipulations, timing limitations, Lease Notices, Required Operating

Procedures[12] and other standard terms and conditions that would directly or indirectly reduce impacts to polar bears. We refer the reader to the *Project Description* and the BA for more extensive discussions of the RFD and Alternative B but we briefly highlight here the important considerations that would affect the spatial and temporal intersect between activities of polar bears and industry.

The Tax Cuts and Jobs Act of 2017, Public Law 115-97 (PL 115-97): The legislation setting the Proposed Program in motion directs the Secretary of the Interior to develop the oil and gas leasing Program described in this BO. This law limits the area on Federal lands within the Program Area that could be covered by production and support facilities to 2,000 surface acres.

Several lease stipulations would apply additional protections to specific areas important to polar bears. Importantly, 359,400 acres (~23%) would be subject to no surface occupancy (NSO) restrictions, and 585,400 acres (~37%) would be subject to timing limitations (TLs). Specific lease stipulations relevant here include:

Lease Stipulation 1: This stipulation provides protection for specific identified rivers and streams by prohibiting permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines within one mile of five rivers and ½ mile of four other rivers and one creek (Figure 4.1). On a case-by-case basis, essential pipelines and roads would be permitted, with specific additional limitations. This protection includes several drainages (Canning River Delta, Katakturuk River, Sadlerochit River, Jago River, and Marsh Creek) that overlap, at least in part, with high density polar bear denning areas, but does not include Carter Creek, which overlaps with a high density denning area, and the Niguarak River, which overlaps with a moderate density denning area (Figure 8.5).

Lease Stipulation 4: This stipulation prohibits exploratory well drill pads, production well drill pads, and CPFs in coastal waters, lagoons, or barrier islands within the boundaries of the Coastal Plain of Arctic Refuge. Other oil and gas facilities, specifically barge landings, docks, spill response staging and storage areas, pipelines, artificial islands, platforms, ice or other roads, and bridges and causeways may be approved on a case-by-case basis, after specific criteria designed to protect other resources and interests are met.

Lease Stipulation 9: A subset of the objective of this stipulation is to “minimize hindrance or alteration of polar bear use and movement in coastal habitats; and protect and minimize disturbance from oil and gas activities to coastal habitats for polar bears and seals.” It also includes the requirement/standard that “Before beginning exploration within 2 miles of the coast, the lessee/operator/contractor would develop and implement an impact and conflict avoidance and monitoring plan to asses, minimize, and mitigate effects on the infrastructure and its use on these coastal habitats and their use by wildlife and people.”

[12] All proposed ROPs will apply to any exploration and development actions that are not dependent on an oil and gas lease (e.g., the area-wide seismic survey contemplated in the June updates to the BA [BLM 2019b]), in the same manner the ROPs would apply to lease-based activities (BLM email dated October 23, 2019).

Many of the Required Operating Procedures (notably 1, 3, 4, 10, 25, and 46) will also serve to reduce potential impacts to polar bears either directly, or by reducing the potential for human-polar bear interactions.

PDCs

During this framework programmatic consultation with the BLM we developed and agreed upon four Project Design Criteria (PDCs) designed to minimize and monitor effects of the Proposed Program to polar bears (and other listed species) and to describe how compliance with section 7(a)(2) of the ESA will be ensured. The first two stem from lease notices that the BLM will issue in writing to all lessees[13], serving notice that all future activities to be authorized under the Program will be required to comply with the MMPA and ESA. The third and fourth reflect procedures developed and agreed to by the BLM and Service to be used when jointly managing the framework program as step-down consultations on future proposed activities are conducted. These four PDCs are repeated here because these measures are important aspects of the BLM's proposed action that figure prominently in our evaluation of the potential effects of the Proposed Program, discussed below.

1. Section 7 Consultation on Future Activities – The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened or endangered. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that would contribute to the need to list such a species or designate critical habitat for listed species. The BLM would not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the ESA, as amended (16 United States Code [USC] 1531 et seq.), including completion of any required procedure for conference or consultation.
2. The lease area and/or potential project areas may now or hereafter contain marine mammals. The BLM may require modifications to exploration and development proposals to ensure compliance with Federal laws, including the Marine Mammal Protection Act (MMPA). The BLM would not approve any exploration or development activity absent documentation of compliance under the MMPA. Such documentation shall consist of a Letter of Authorization, Incidental Harassment Authorization, and/or written communication from USFWS and/or NMFS confirming that a take authorization is not warranted.
3. The Service and the BLM will conduct programmatic reviews by meeting at least annually beginning one year after the first Lease Sale. These reviews will evaluate, among other things, 1) whether activities proposed are consistent with the RFD, as described, for the Proposed Program, 2) whether the nature and scale of predicted

[13] The requirements of Lease Notices 1 and 2, which form the basis of PDCs 1 and 2, will also apply to any exploration and development actions that are not dependent on an oil and gas lease (e.g., the area-wide seismic survey in the June updates to the BA [BLM 2019b]), in the same manner the Notices would apply to lease-based activities (BLM email dated October 23, 2019).

effects remain valid, and 3) whether the programmatic consultation, including the PDCs and determinations reached, remain adequate and appropriate. In addition, these meetings will provide a venue where any new information on the status of species, their critical habitat, or new methods to avoid or minimize impacts can be shared.

4. All activities, including plan development, study development, and consideration of exceptions, modifications, or waivers would include coordination with the FWS as the surface management agency and would comply with ESA. In addition, the BLM would coordinate with other appropriate federal, state, and North Slope Borough agencies, tribes, and Alaska Native Claims Settlement Act corporations.

MMPA

There are two regulatory programs implemented under authority of the MMPA that substantially limit potential impacts of the Proposed Program to polar bears. These programs, one giving the Service the authority to allow incidental (non-intentional) take of polar bears, and one that provides a mechanism for managing human-polar bear interactions to promote conservation of bears while protecting human safety, are summarized here.

Incidental Take Program. -- Section 101(a)(5) of the MMPA gives the Service the authority to allow the incidental, but not intentional, taking of marine mammals.[14] Under this authority, "upon request by citizens of the United States who engage in a specific activity (other than commercial fishing) within a specified geographical region, the Secretary shall allow, during periods of not more than five consecutive years each, the incidental but not intentional, taking by citizens while engaging in that activity within that region, small numbers of marine mammals of a species or population stock[15]" if it is found that "the total of such taking during each five-year (or less) period concerned will have a negligible impact on such species or stock and will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses." If those conditions are met, the Service, acting on behalf of the Secretary, issues an incidental take regulation (ITR[16]) setting forth: (a) permissible methods of taking; (b) means of effecting the least practicable adverse impact upon the species or stock and its habitat,

[14] "Take" is defined somewhat differently under the MMPA than under the ESA. Not all acts that result in incidental take under the MMPA necessarily result in incidental take under the ESA. This distinction is relevant to this BO given the Proposed Program's requirement that lessees, operators, and contractors comply with the MMPA and its more protective definition of take. The distinction may also be important to step-down consultations that more specifically address incidental take under the ESA.

[15] The small numbers and negligible impact determinations for polar bears would be made at the stock scale, because for purposes of management under the MMPA, polar bears in the United States were delineated as comprising two stocks, the Chukchi Sea and Southern Beaufort Sea stocks. We note, however, that in the Polar Bear CMP and other Service documents the SBS stock is also referred to as the SBS subpopulation. Therefore, we consider these terms to be interchangeable and synonymous.

[16] Incidental, non-lethal harassment of marine mammals can also be authorized under section 101(a)(5)(D) of the MMPA by issuing Incidental Harassment Authorizations (IHAs). To qualify for an IHA, a proposed activity must meet the same protective standards (including no more than small numbers can be taken, causing no more than a "negligible impact" to the stock, conducted using means of effecting the least practicable impact on the species or stock and its habitat) required under the ITR/LOA process. IHAs cannot be issued for a period of longer than one year, however, so we have traditionally employed ITRs to allow incidental take of polar bears. We acknowledge that this alternate approach could be used at times, however.

and the availability of the species for subsistence harvest; and (c) requirements for monitoring and reporting (more detail is available at U.S.C. 1371(a)(5)(A) and 50 C.F.R. 18.27).

The terms “negligible impact,” “small numbers,” and “unmitigable adverse impact” are defined at 50 CFR 18.27. “Negligible impact” is defined as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival. “Small numbers” is defined as a portion of a marine mammal species or stock whose taking would have a negligible impact on that species or stock. However, we do not rely on that definition, as it conflates the terms “small numbers” and “negligible impact,” which we recognize as two separate and distinct requirements. Instead, in our small numbers determinations, we evaluate whether the number of marine mammals likely to be taken is small relative to the size of the overall stock.

“Unmitigable adverse impact” is defined as an impact resulting from the specified activity 1) that is likely to reduce the availability of the species or stock to a level insufficient for a harvest to meet subsistence needs by (i) causing the marine mammals to abandon or avoid hunting areas, (ii) directly displacing subsistence users, or (iii) placing physical barriers between marine mammals and the subsistence hunters; and 2) that cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met. The term “least practicable adverse impact” is not defined in the MMPA or its enacting regulations. We ensure the least practicable adverse impact by requiring mitigation measures that are effective in reducing the effects of the proposed activities, but are not so restrictive as to make conducting the activities unduly burdensome or impossible to undertake and complete.

Since 1993, the oil and gas industry operating in the Beaufort Sea and adjacent northern coast of Alaska has requested, and been issued, ITRs for incidental take of polar bears in specific areas during specified activities. Under these ITRs, companies, groups, or individuals proposing to conduct specified activities, may request a “letter of authorization” (LOA) granting authorized non-lethal, incidental Level B take of polar bears. Requests must include an operations plan for the activity, a polar bear interaction plan, and site-specific monitoring and mitigation plan that specifies the procedures to monitor and mitigate the effects of the activities on polar bears. Each LOA is conditioned on specific circumstances for the activity and location to ensure the activity and level of take are consistent with the ITRs.

ITRs previously issued for the Beaufort Sea region, the most recent of which were issued in August, 2016 (81 FR 52276-52320), have not included the Coastal Plain of Arctic Refuge within the “specified geographical region” to which the ITRs applied. Therefore, a new ITR including this area would need to be developed prior to issuing any LOAs for activities associated with the Proposed Program, and doing so would require the necessary criteria (small numbers, negligible impact, etc.) to be met. Further, ITRs allowing incidental take of polar bears caused by the proposed Program would need to be renewed and re-evaluated at least every 5 years, and could be renewed only if doing so would again meet the “small number” and “negligible impact” standards at the stock (SBS subpopulation) scale. Additionally, promulgation of an ITR that would allow incidental take under the MMPA is a Federal action and therefore is subject to section 7 of the ESA, which entails assessment of the current status of the species and critical habitat, environmental baseline, cumulative effects, and effects of the action. Thus, every 5 years or less, when a new ITR is promulgated to evaluate and authorize incidental take of polar bears, activities that would be likely to cause incidental take are reviewed relative to the standards of both the ESA and MMPA.

The substantive standards applied during the MMPA incidental take authorization process are in certain respects more stringent, i.e. more protective for polar bears, than those applied during ESA consultation. To comply with the "negligible impact" standard under the MMPA, the proposed action "cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock…" To avoid "jeopardy" under the ESA, the proposed action cannot result in "an appreciable reduction in the likelihood of both the survival and recovery of the listed species." Thus, the MMPA is more protective than the ESA in terms of the threshold for allowable impacts (*adverse effect* under the MMPA versus *appreciable reduction in the likelihood of survival and recovery* under the ESA) and the scale at which unallowable population-level impacts would occur (*species or stock* level for the MMPA versus the *listed species* level for the ESA). Hence, impacts that can be allowed under the incidental take provisions of the MMPA are not likely to jeopardize the continued existence of a marine mammal species *per* 7(a)(2) of the ESA.

Deterrence. -- In addition to the regulatory program allowing for incidental take of polar bears described above, the MMPA also provides a mechanism for managing human-polar bear interactions in order to promote conservation of bears while protecting human safety. This Deterrence Program, authorized under section 101(a)(4)(A) of the MMPA, provides Letters of Authorization (LOAs) that allow the use of deterrence actions to prevent polar bears from damaging private property or endangering personal safety. Under this authority, Federal, State and local government employees may deter polar bears for the welfare of the animal when acting in the course of their official duties, and private persons (such as employees of the oil and gas industry) may enter into cooperative agreements with the Service to carry out deterrence measures when acting in their capacity as designated persons under such an agreement and in full compliance with its terms and conditions. This program strives to: 1) prevent bears from associating food with humans and communities, 2) "condition" bears to avoid humans, human activities and communities, 3) promote movement of bears by actively redirecting them into corridors, such as coastal travel routes, 4) minimize extended use of areas near communities, and 5) minimize bear entry into communities.

Importantly, the program mandates that "active deterrence actions must not result in the death or serious injury of any marine mammal," and requires an application that includes: a) a detailed plan of operations, b) a site-specific plan to monitor effects of the activity on polar bears present during activities, and c) a site-specific polar bear interaction plan that outlines steps the applicant will take to limit animal-human interactions, increase site safety, and minimize impacts to polar bears. The program does not allow for the deterrence of polar bears for convenience or to aid project activities, and prior to conducting deterrence activities operators must make reasonable efforts to reduce or eliminate attractants (e.g., garbage, human waste, and food); move personnel to safety; ensure the bear has escape route(s); and begin with the lowest level of force or intensity that is effective and increase the force or intensity only as necessary to achieve the desired result. The program also contains specific training, monitoring, and reporting requirements to minimize risk and impacts to polar bears. This program has been in place for decades, and although deterrence actions result in negative impacts to individual bears on rare occasions, the use of deterrence actions effectively reduces the need for lethal take of polar bears, and thus as a whole contributes to the conservation of polar bears.

For example, from January 1, 2001 through December 31, 2016, the oil and gas industry on the North Slope reported sightings of 4,371 polar bears, of which 848 (19%) were deterred. Of those deterred, the vast majority were subjected to noise or visual stimuli (e.g., vehicle horns, engine noise, yelling, spotlights, sirens, or discharge of cracker shells) intended to direct bears away from facilities or human activities. On rare occasions, when less-intrusive methods failed, "direct contact" rounds such as bean bags or rubber bullets were used. During 640 deterrence events by industry on the North Slope from 2001 – 2016, 42 polar bears were deterred with bean bags and 6 with rubber bullets. Injuries or lethal impacts are exceptionally rare. In 2011, a polar bear died because personnel mistakenly used a crackershell to deter a bear at close range rather than a beanbag round.

In sum, the Service manages two distinct but related programs under authority of the MMPA that result in significant conservation for polar bears in Alaska where human activities, including oil and gas development, take place. Combined, these programs entail a comprehensive review of the various mechanisms through which oil and gas activities directly or indirectly affect polar bears, which are evaluated when 1) reaching small numbers and negligible impact determinations, 2) crafting project-specific measures to avoid or minimize impacts in LOAs, and 3) providing monitoring and reporting requirements.

These Service has a long track record of implementing these programs in the Beaufort Sea region. During the 16-year interval between January 1, 2001 and December 31, 2016, 519 LOAs were issued for oil and gas work on the North Slope, and polar bears were observed during activities associated with 173 (33 percent) of the LOAs. Industry reported 2,731 observations of 4,371 polar bears, although some reports include multiple observations of the same bears, so this total over estimates the number of individual bears encountered. Analysis of reports indicated that of bears encountered, 24 percent (1,064) experienced Level B take including 236 Level B takes by incidental disturbance, 818 Level B takes by deterrence, and 8 Level B takes for which the cause was not reported. There were 2 Level A takes and 66 polar bears encountered for which the outcome was unknown. Based on this evaluation, combined with a detailed description of activities proposed for August 5, 2016 through August 5, 2021, we concluded that impacts of incidental take would affect only small numbers of polar bears, would result in a negligible impact to the SBS subpopulation, and would not have an unmitigatable adverse effect upon the availability of polar bears for subsistence users.

The Service would need to make these same findings with respect to polar bears in the Program Area prior to authorizing any Proposed Program-related activity with the potential to take polar bears. The Service's reviews would account for site-specific characteristics of the Program Area and any updated information concerning changing environmental conditions and changes to the status of the polar bear, and would identify the means of effecting the least practicable adverse impact upon the SBS stock of polar bear, and its habitat.

Summary of Factors Serving to Minimize Effects
In summary, the RFD contains lease stipulations, associated TLs and NSO provisions, Lease Notices, and ROPs that would directly or indirectly reduce impacts to polar bears. Additionally, four PDCs have been developed and implemented specifically to minimize and monitor effects of the proposed Action to listed species and marine mammals. These PDCs ensure, among other things, that future actions and activities to be authorized under the Proposed Program will comply with the ESA and MMPA. In particular, compliance with the MMPA requires authorization for take caused incidentally or through intentional deterrence actions, and requires that no more than small numbers of the SBS stock are taken, and that such taking would have no more than a negligible impact upon the SBS stock.

8.5.4 Effects to polar bears

Disturbance
Oil and gas activities could potentially disturb polar bears, impacting denning and non-denning individuals. Disturbance could result from noise associated with human activities including use of vehicles, aircraft, vessels or machinery, or by creating obstructions to movements. Disturbance could originate from stationary or mobile sources. Stationary sources could include construction, maintenance, repair, operations at staging pads, production and processing facilities, gas flaring, and drilling operations. Mobile sources could include vessel and aircraft traffic, seismic and geophysical surveys, ice and gravel road construction, vehicle traffic, tracked vehicles and snowmobiles, the movement of modules and other equipment to and from staging facilities, drilling, and dredging.

Industry activities could affect denning polar bears by obstructing or altering movements of pregnant females as they prospect for den sites; by disturbing females at den sites before cubs are born, which could force the female to search for an alternate site; or, by causing premature den site abandonment after cubs are born, which could cause the immediate death of cubs or reduced probability of survival over time, which would be difficult to detect or measure. Records from the North Slope (and elsewhere) suggest variable response to disturbance near dens, with some bears successfully denning near infrastructure or mobile sources of disturbance (such as seismic surveys), while others have abandoned dens outright or prematurely (81 FR 52292; BLM 2019). Some polar bears have apparently become habituated to nearby activities (Smith et al. 2007) but the extent to which habituation to disturbance could reduce impacts is unknown (Amstrup 1993). The Beaufort Sea ITRs include stipulations requiring polar bear den surveys before winter oil and gas activities commence, and impose a one mile (1.6 km) operational exclusion zone be established around detected dens restricting the timing and types of such activities, thereby minimizing or avoiding disturbance to denning bears. Similar measures can be applied to activities in the Program Area, if deemed appropriate during development of future ITRs (or IHAs). Thus far, ITRs for polar bears implemented under the MMPA described above have been effective at reducing impacts to denning polar bears, even when we account for the possibility that impacts may have been underestimated if effects occurred at undetected dens or if effects to fitness were manifested later, away from den sites.

Mobile sources of sound, such as transport of materials or geophysical surveys in nearshore marine waters, could disturb polar bears, although industry activities are typically conducted in relatively ice-free, open water. Polar bears regularly cross open water; for example, when moving from pack ice to shore, but oil and gas industry records have indicated interactions between polar bears and industry activities in open water have been relatively rare (C. Putnam, USFWS - Marine Mammals Management Office, *pers. comm*.). Should encounters occur, polar bears would likely move away from the source of disturbance, resulting in a short-term temporary behavioral disturbance.

Aircraft traffic could disturb polar bears in winter during denning or along the coast in late summer/fall when and where non-denning bears concentrate. Low-level flights near denning habitat or occupied dens could cause premature den abandonment. The responses of non-denning polar bears to aerial surveys, generally flown at lower altitudes than aircraft associated with oil and gas activities, indicate that impacts would be limited to short-term changes in behavior, ranging from no response to departing the area in haste, depending on distance, flight altitude, type of aircraft (fixed-wing or helicopter), and other factors. As described above, the density of polar bears along the coast in late summer is greater near Kaktovik than elsewhere between Utqiaġvik and the Canada border, despite considerable air traffic in and out of the Barter Island Airport, which is located about 2.5 miles (4.0 km) from the bone pile where polar bears regularly exploit whale carcasses. This indicates some degree of tolerance or that some bears may habituate, at least in situations where aircraft follow predictable flight and landing patterns.

Industry facilities could also obstruct movements of bears, including movements of pregnant females moving from sea ice into terrestrial areas to prospect for den sites in autumn and early winter, or those of non-denning bears near or along the coast or barrier islands in late summer and autumn. However, polar bears regularly traverse oil and gas facilities along the Beaufort Sea coast to the west of the Proposed Program Area, crossing roads and causeways in some situations and moving around them in others. As a result, infrastructure appears to provide only small-scale, local obstructions that polar bears move through or circumvent, depending on location and other circumstances. Females and cubs returning to sea ice from terrestrial den sites may be more sensitive to disturbance than non-denning bears, due to the nutritional state of the female after months of fasting and the small size and other physiological limitations of cubs immediately after abandoning dens.

Quantitative evaluation of the potential effects of disturbance of polar bears from the proposed action is constrained by potential future changes in the abundance, distribution and response of polar bears, which is further compounded by uncertainty about the nature, location, and timing of activities that would be proposed. However, several factors, presented in greater detail above, will serve to limit impacts. Public Law 115-97 limits the surface area to be covered by production and support facilities to 2,000 Federal acres[17]. Lease stipulations 1, 4, and 9 associated with Alternative B collectively provide conservation measures for a subset of habitat used by polar bears, including terrestrial denning habitat along 10 rivers or creeks; coastal waters, lagoons and barrier islands, and areas within 2 miles of the coast; and require conflict avoidance and monitoring plans to minimize impacts to polar bear movements and habitat within 2 miles of the coast. PDCs 3 and 4 describe processes for the BLM and the

[17] This limit applies exclusively to Federal lands subject to leasing under the authority of PL 115-97 but not to private lands within the geographic boundary of the Coastal Plain of Arctic Refuge.

Service to use when implementing the programmatic framework consultation, specifically commitments to conduct annual program reviews and consult when developing program plans, studies, and authorizing exceptions, modifications, or waivers to lease stipulations or ROPs to ensure impacts to polar bears are considered and compliant with requirements of the ESA.

More important, however, are PDCs 1 and 2, which require that protections of the ESA and MMPA will be applied to all activities proposed under the Program. PDC 1 reiterates the BLM's commitment in Lease Notice 1 that activities under the Proposed Program will not be approved until applicable requirements of the ESA are met. This will provide for project-specific stepdown consultations that will in turn facilitate periodic re-evaluation of the adequacy of the framework programmatic consultation and ensure continued compliance with section 7(a)(2). The most important factor minimizing potential impacts of the Proposed Program to polar bears is PDC 2, which reiterates the BLM's commitment in Lease Notice 2 to require documentation of compliance with the MMPA prior to commencement of activities proposed and authorized under the Program. This is a very protective measure, and specifically applies to minimizing the impacts of disturbance. As described above, and demonstrated by the current Beaufort Sea ITRs for Alaska's existing oil and gas industry, the incidental take program administered under the MMPA provides a mechanism that allows for the incidental taking of polar bears but only after it is determined that doing so will only affect small numbers of the SBS stock, and will have at most, a negligible impact upon the stock. Any ITR (or IHA) issued for activities associated with the Proposed Program must also specify permissible methods of taking, along with other means of effecting the least practicable impact on the SBS stock of polar bear (as well as its habitat). Further, the mechanism most commonly used for authorizing incidental take of polar bears (i.e., ITRs) must be renewed at least every five years (or annually in the case of IHAs), ensuring periodic re-evaluation of the status of polar bears, impacts of the program, efficacy of the minimization measures contained in take authorizations, and review of the results of monitoring and reporting requirements.

The Beaufort Sea ITRs have a multi-decadal track record of analyzing potential impacts from oil and gas activities to polar bears and prescribing measures to achieve the least practicable adverse impact. While some impact to polar bears has occurred from such activities, in order to issue new five-year sets of regulations, the Service has had to determine that the predicted level of impact would affect no more than small numbers of polar bears from the SBS stock and have no more than a negligible impact. Given that this determination has been made prior to issuance of each new set of ITRs, it demonstrates that the level of impact is well below a jeopardy level for the overall polar bear species. It is reasonable to assume that any ITRs/LOAs and/or IHAs developed to authorize incidental take from activities authorized by BLM under the Proposed Program that is the subject of this consultation would be achieve similar results. The recurring, project-specific reviews required under the MMPA and the Proposed Program will enable the Service to account for any unique characteristics of the Program Area and to respond to changes in the status of the polar bear. Further, LOAs or IHAs authorizing incidental take from actions or activities proposed under the Program would include additional, project-specific requirements and mitigation measures as necessary to make determinations under the MMPA. For example, projects proposed in suitable habitat during denning season (such as seismic surveys or ice road construction) could require den searches or timing restrictions to protect dens and aircraft overflights during non-denning season could include restrictions to avoid areas where bears concentrate. In the unlikely event that a proposed activity cannot be designed or mitigated in a manner that meets the MMPA's substantive standards, then that project would require modification or additional mitigation, or the incidental take could not be authorized.

Despite our inability to quantitatively evaluate potential impacts of disturbance to polar bears from the proposed RFD, based on PDC 2, we conclude that because any permit will require compliance with the MMPA, the effects of disturbance will have to be limited to individual-level impacts to a small number of polar bears that would cause no more than a negligible impact to the SBS stock.

As noted in the Conservation Management Plan for polar bears, it is expected that polar bear populations will decline as sea ice conditions decline. The recovery strategy is intended to manage human-caused impacts with the goal of not appreciably increasing the rate of decline such that the species can stabilize at a lower population size, consistent with a lower carrying capacity. Given that we have concluded that the Proposed Program will cause no more than a negligible impact to the SBS stock of polar bears, it is reasonable to conclude that the Proposed Program will not appreciably affect the rate of decline and therefore will not appreciably affect the prognosis for recovery of the SBS subpopulation and of the species overall.

Human-Polar Bear Interactions

Based on the BA, and drawing from our experience implementing the most recent ITRs for polar bears for the Beaufort Sea region (81 FR 52276 – 52320), we consider how the proposed RFD may result in potentially harmful interactions between humans and polar bears, specifically: collisions with vehicles on winter routes or gravel roads, collapse of undetected dens caused by winter equipment movements, attraction of bears to facilities or human activities, and deterrence actions, which could result in injury or death of polar bears in defense of human life. In the following discussion, we will combine the topics of the attraction of polar bears to facilities or human activities and deterrence actions, as they are inextricably linked.

The BA identified that traffic on ice roads (and presumably gravel roads) could pose a collision risk to polar bears. However, with the exception of concentrations in late summer and autumn along the coast, particularly near Kaktovik, polar bears generally occur at low density on the landscape. Further, activities are generally tightly regulated in industry developments, including speed limits on in-field thoroughfares. Therefore, although we acknowledge the possibility, we conclude that vehicle-polar bear collisions would be extremely rare.

Tracked or rubber-tired vehicles moving over snow in winter could encounter and collapse undetected dens. Although vehicles used on snow are designed to distribute ground pressure, dens in drifted snow would be unlikely to withstand any considerable additional weight, therefore, if equipment were to encounter an undetected den, the den would likely collapse, resulting in injury or death of the cubs and/or female. The likelihood of one or more such events would be proportional to a 1) the density of dens in the Program Area (estimated to be approximately 19 dens each winter in the Coastal Plain of Arctic Refuge; USFWS unpubl. data), and 2) the area impacted by winter tundra travel. This risk could be eliminated by avoiding winter tundra travel within denning habitat, or by delaying tundra travel in denning habitat until after females and cubs naturally abandon den sites. Alternately, risk could be reduced through den searches and establishing protective buffers around dens until they are abandoned. However, the efficacy of the latter approach would be proportional to the probability of detecting all dens during searches. Thus, if activities requiring winter tundra travel (e.g., seismic surveys or ice road construction) are proposed to overlap with denning habitat and the period of den occupancy, there would be the potential for den destruction, at least with current methods of den detection.

Facilities and human activities, including those associated with industry, occasionally attract polar bears, which may be motivated by hunger or curiosity. This could have consequences for bears drawn to human activities if deterrence or defense of life actions result. However, proactive measures to identify and minimize attractants are required components of applications for take authorizations under the MMPA, including authorizations for both incidental take and deterrence actions. For example, LOA applications for incidental take under the most recent Beaufort Sea ITRs require "an approved polar bear safety, awareness, and interaction plan on file with Service's Marine Mammals Management Office" and this plan must include a "food, waste, and other "bear attractants" management plan" (USFWS 2016). In addition, several Required Operating Procedures described in the BLM's BA and Final EIS address food and waste management.

As when evaluating disturbance, we find quantitatively evaluating potential effects of human-polar bear interactions from the Proposed Program to be constrained by uncertainties regarding the future abundance, distribution and response of polar bears, compounded by uncertainty about the nature, location, and timing of activities that would be proposed under the Program. Again, however, the same factors serve to limit the consequences of human-polar bear interactions. These are the Federal surface area limit associated with Public Law 115-97, and the conservation benefits afforded by Lease Notices, Lease Stipulations, and Required Operating Procedures associated with Alternative B. Additionally, PDCs 3 and 4 would enhance the conservation benefits accrued during step-down section 7 consultations to be conducted on future activities proposed and/or authorized under the Program. Further, and more importantly, PDCs 1 and 2 require the protections of, and compliance with, the ESA and MMPA be applied to all future activities proposed under the Program. PDC 1 reiterates the BLM's commitment that activities under the Proposed Program would not be approved until applicable requirements of the ESA are met. This would provide for periodic re-evaluation of the adequacy of the framework programmatic consultation and ensures continued compliance with section 7(a)(2). The most important factor minimizing potential impacts of the Proposed Program is PDC 2, which reiterates the BLM's commitment to require documentation of compliance with the MMPA prior to commencement of activities to be authorized under the Program. When managing human-polar bear interactions, MMPA compliance is likely to include acquiring and complying with LOAs for incidental take and deterrence actions. Based on the success of these programs to date in the Beaufort Sea region west of the Program Area, we expect compliance with the MMPA would effectively prevent 1) winter vehicles from encountering and destroying dens, 2) chronic, harmful attraction of polar bears to industry activities and/or facilities, and 3) the need for injurious or lethal deterrence actions. Therefore we conclude, based implementation of PDC 2, that effects of human-bear interactions would be limited to individual-level impacts to a small number of polar bears.

Spills of oil and other petroleum products

Accidental spills of oil or other petroleum products resulting from activities during all phases of the RFD could originate from anchor fields (e.g., CPF and satellite pads), terrestrial pipelines, and vessels operating in the Action Area. Spills of contaminants could reach the marine habitat of polar bears, including sea ice, marine waters, and coast lines including barrier islands, through spills from vehicles on sea ice, spills from vessels in marine waters, or spills in terrestrial areas being transported downstream to coastal areas or marine areas.

Exposure to oil could impact polar bears in several ways, depending on the volume, location, and timing of a spill, and the severity and manner of exposure. Polar bears could make direct contact with spilled oil or ingest it through grooming fouled fur, nursing, or by ingesting contaminated prey, or inhaling vapors (Engelhardt 1983). Consequences could include irritation to eyes, mouth, and mucus membranes, irritation and damage to respiratory organs from inhalation, kidney and liver damage from ingestion of contaminated prey (Ortisland et al. 1981), loss of ability to thermoregulate, hair loss, anemia, anorexia, increased metabolic rate, elevated skin temperatures, and stress response (Derocher and Stirling 1991; St. Aubin 1990). Exposure could range from short-term, sub-lethal impacts to long-term impacts on health including death, depending on the substances contacted, the magnitude and duration of exposure, and the health of exposed individuals.

Records of polar bears encountering spilled oil or other toxic substances in Alaska suggest exposure could occur from the Proposed Program but would likely be infrequent and/or impact small numbers of individual bears. Since 1993, the Service has interacted with the oil and gas industry in northern Alaska to evaluate, regulate, and monitor effects of oil and gas exploration, production, and processing on polar bears. In this interval, large oil spills impacting polar bears have not occurred. One polar bear died in 1988, after exposure to ethylene glycol and dye (Amstrup 1989), and two bears died in 2012 after chemical exposure, including Rhodamine B (81 FR 52297). Although this compound is used by the oil and gas industry, it is also used by others on the North Slope, so the 2012 events cannot be attributed to industry (81 FR 52297). Between July 1, 2009 and June 30, 2014, spills averaging about 59,000 gallons per year were reported by industry on the North Slope, with approximately 5.6 percent of the volume comprised of crude oil (81 FR 52299). None of these spills were documented to have injured or killed polar bears.

Although small spills (< 500 bbl) associated with the RFD could occur during winter exploration, and year-round development and production activities, due to measures required by Lease Stipulations 4 and 6, and ROPs 1-3, 21, and 46, spills are expected to be uncommon (BLM 2019). Furthermore, due to low density of polar bears throughout most of the Action Area, we expect the likelihood of polar bears encountering oil from small terrestrial or marine spills would be low (with an exception to this generalization discussed below). Small spills would be more likely to occur than large spills, and the BLM expects the majority of small spills would occur on production pads, be confined to a small area, and be remediated quickly. Small marine spills (e.g., at barge landings) would be expected to be contained or weather quickly (i.e., within 24 hours; BLM 2019), and small onshore spills would likely be fully recovered (e.g., oiled tundra would be entirely removed and disposed of; BLM 2019). Although disturbance of polar bears could occur during spill response efforts, this disturbance is expected to be minor and temporary as polar bears would be expected to move away to a safe distance. In their proposed RFD, the BLM did not project spills >500 bbl, therefore the consequences of a large spill are not considered to be reasonably certain to occur.

Although polar bears generally occur at low density in the Action Area, an average of 140 polar bears (up to 15 percent of the SBS subpopulation) occur in late summer and fall along the Beaufort Sea coast between Utqiaġvik and the U.S./Canada border, with a substantial proportion (about 64%) of observations occurring on or near Barter Island on the northern edge of the Coastal Plain of Arctic Refuge. Thus, in the event that oil spilled on sea ice, in marine waters, or in freshwater streams or rivers that could transport oil to the coast, the potential for polar bears to be exposed to spilled petroleum products exists. However, several factors serve to limit potential exposure. Lease Stipulations 4 and 6, and ROPs 1-3, 21, and 46 will serve to reduce the likelihood of spills occurring, particularly in areas where polar bears den or feed (BLM 2019).

Further, the Proposed Program does not allow for exploration, production, or processing facilities are prohibited in offshore waters or on barrier islands, which would limit the location of potential spills to terrestrial habitat, and this would greatly restrict transportation of spilled oil. Finally in 2016, the Service, working with numerous partners, developed a detailed species-specific oil spill response (OSR) plan in the event a spill occurs. This plan provides guidance for the Service's Alaskan Regional Spill Response Coordinator in determining potential risk to polar bear populations and advising the Federal On-Scene Coordinator on recommended response measures. The OSR plan includes information on preventative measures to keep bears out of oil, such as early detection and deterrence, as well as guidance on treatment of oiled bears, such as washing and holding protocol. Appendices include information on collecting and removing oiled wildlife carcasses; location/inventory of equipment and supplies; and a list of potential holding facilities and response partners that would be called upon to assist as needed. Service response efforts would be conducted using the standard three-tiered spill-response approach:

1) **Primary response** – identifying bear use areas and making recommendations to the Incident Command System where to focus containment, dispersion, burning, or clean-up of oil to minimize impacts to polar bears;
2) **Secondary response** – using hazing, herding, preventative capture/relocation, or additional methods to remove un-oiled polar bears from affected or potentially-affected areas; and
3) **Tertiary response** – capture, cleaning, treatment, and release of oiled polar bears.

In summary, we note that spills of oil and other petroleum products are expected to be infrequent and of low volume, small spills are expected to be contained or weather quickly, and material handling, spill prevention, and response measures required by the BLM through Lease Stipulations and ROPs include numerous measures to minimize impacts to polar bears in the event of a spill.

Further, prohibitions against oil and gas exploration, production, and processing in offshore waters and/or on barrier islands indicates that most spills would occur in terrestrial areas, where the density of bears is low and containment and response efforts are likely to be effective. Also, polar bear density in the Action Area is generally low, minimizing the number of bears potentially exposed to spills. Additionally, a polar bear-specific response plan has been developed to guide response efforts in the unexpected event that a spill with potential to affect polar bears occurs.

Finally, as with disturbance and human-polar bear interactions, implementation of the four PDCs will ensure periodic re-evaluation of activities proposed under the Program. This will require compliance with the MMPA and section 7(a)(2) of the ESA, as described in detail above. In particular, when issuing ITRs allowing for incidental take of polar bears under the MMPA, assessment of all factors causing take, including impacts from oil spills in the Action Area and elsewhere that affect the SBS will be required. Therefore, we conclude the effects of exposure to spilled oil and other petroleum products would be limited to individual-level impacts to a small number of polar bears, which will cause no more than a negligible impact to the SBS stock.

Impacts to Polar Bear Prey Species

The fecundity or survival rates of polar bears could be affected if the proposed action affects polar bear prey populations. Polar bears are top predators in the Arctic marine ecosystem, and in the SBS region, they prey primarily on ringed, and to a lesser extent, bearded seals, although other food sources, including beach-cast and subsistence-harvested marine mammal carcasses are occasionally important (USFWS 2016). We note that the NMFS manages ringed and bearded seals under the authorities of the MMPA and ESA, and we defer to their impact analyses regarding the effects of the proposed action to these species now, and when future oil and gas activities are proposed. However, because impacts to ringed and bearded seal populations could indirectly affect polar bears, it is relevant to consider the potential impacts on ice seals upon which polar bears depend.

The NMFS currently identifies[18] the following mechanisms by which the Proposed Program could affect ice seals: acoustic disturbance from aircraft, seawater treatment facilities, exploratory vibroseis surveys, vessel traffic in the MTR, contamination from small oil spills, harassment or harm from vehicles during vibroseis surveys, vessel strikes in the MTR; and impacts at barge landings (BLM memorandum dated September 11, 2019). Because ringed and bearded seals in U.S. waters off Alaska’s coast are classified as threatened under the ESA (77 FR 76706 and 77 FR 76740), NMFS and the BLM have initiated a framework programmatic consultation under section 7 of the ESA. Therefore, we assume PDCs 1 and 2 would require NMFS and BLM to ensure that impacts to ringed and bearded seals remain compliant with the regulatory standards of the ESA and MMPA which ensures proposed activities would not jeopardize the continued existence or recovery of ringed and bearded seals, which in turn ensures they will be available as prey for polar bears. Further, PDCs 1 and 2 require the BLM and the Service to ensure that all effects of the Program to polar bears, including impacts to prey species, remain compliant with the regulatory standards of the ESA and MMPA.

[18] NMFS is currently evaluating these impacts under section 7 of the ESA at the time of this consultation, therefore final results of their initial framework programmatic consultation are not reflected in this BO.

Summary

We identify the following four primary mechanisms by which the Proposed Program could affect polar bears: disturbance, human-polar bear interactions, spills of oil and other petroleum products, and impacts to polar bear prey. We also identify the multiple aspects of the Proposed Program (lease stipulations, associated TLs and NSO provisions, Lease Notices, ROPs, and four PDCs) that will serve to limit potential impacts to polar bears. In evaluating effects from the Proposed Program, we draw on our experience evaluating, regulating, and monitoring similar activities in northern Alaska, including in the Chukchi Sea region and Beaufort Sea region to the west of the Program Area, where we have worked cooperatively with the oil and gas industry since 1993 to implement regulatory programs provided for under the MMPA and to conserve polar bears in the face of considerable industrial development. As described above, these regulatory programs require periodic (every 5 years) region- and stock-specific review of the impacts to ensure the regulatory requirements of the MMPA are continuing to be met. The vast majority of impacts caused by industrial activities have been non-injurious and non-lethal, although unintended and unexpected outcomes causing injuries or death have very rarely been documented, and additional injurious or lethal impacts may have occurred but gone undetected or unreported. Known examples include defense-of-life actions and possible undetected impacts of disturbance at undetected dens or females abandoning dens with cubs prematurely, with unknown impacts to the fitness of cubs. Information concerning such events, provided by industry and otherwise available has resulted in continued refinement of the protective measures required of industry. We expect the regulatory programs administered under the MMPA to continue to refine and prescribe permissible methods of taking and other means of effecting the least practicable adverse impacts on polar bears, and thus continue to ensure conservation.

In sum, the Service's experience in regulating similar oil and gas activities in the Beaufort Sea region informs our evaluation of effects and supports our expectation, as explained in the subsections above, that activities conducted under the Proposed Program would not individually or collectively cause population-level effects to the polar bear. We conclude the combination of factors incorporated into the Proposed Program would serve to address and directly or indirectly reduce effects to polar bears, ensuring that no more than small numbers of the SBS stock are taken, and that such taking would have no more than a negligible impact upon the SBS stock.

8.6 Effects to Polar Bear Critical Habitat

Within the Program Area, a total of 1,271,600 acres are designated as critical habitat for polar bears, including subsets of all three designated units. The Program Area contains 7,600 acres within Unit 1, Sea Ice Habitat; 1,193,600 acres within Unit 2, Terrestrial Denning Habitat; and roughly 1,400 acres within Unit 3, Barrier Island Habitat (BLM 2019). Additionally, effects of the action could extend outside the boundaries of the Program Area if proposed activities on sea ice or in the Marine Transit Route (MTR) would occur in, or affect, designated critical habitat outside the discrete Program Area.

To evaluate potential effects of the Proposed Program to polar bear critical habitat, we separately consider the Sea Ice, Terrestrial Denning Habitat, and Barrier Island units. For each unit, we consider potential impacts to the physical and biological features (PBFs) of the habitat that were identified within the designation. Also, for the Terrestrial Denning Habitat and Barrier Island units, we consider whether human presence or activities could compromise the value of critical habitat, because absence of disturbance was described as an attribute of both units.

8.6.1 Unit 1, Sea Ice Habitat

Sea Ice Habitat comprises roughly 114,885,222 total acres, of which, 7,600 acres (~0.006 percent) occurs within the Program Area (BLM 2019). When designating polar bear critical habitat, we "determined that sea ice that moves or forms over the shallower waters of the continental shelf (300 meters (982.2 feet) or less)," and that contains adequate prey resources (primarily ringed and bearded seals) to support polar bears. Sea ice is an essential physical feature for polar bears in the southern Beaufort, Chukchi, and Bering seas for food and physiological requirements (75 FR 76086 – 76137). Activities resulting from the Proposed Program could affect this essential physical feature through three mechanisms: 1) damage to the physical characteristics of sea ice caused by vehicular travel across ice, 2) spills of oil or other petroleum products into marine waters that form ice, or directly onto ice, and, 3) impacts to ringed and bearded seals, caused by disturbance or spills of oil or other petroleum products. These impacts could affect sea ice in Unit 1 within the limited area of overlap with the Program Area, or elsewhere within the broader Action Area.

Based on the BLM's RFD and supplementary information (email from C. Perham, BLM, dated August 28, 2019), vehicular transport of materials, equipment, or personnel across sea ice during winter could occur. Sea ice routes would presumably consist of narrow linear trails occupying an extremely small proportion of the ice surface. Further, we assume that measures required to ensure safety of personnel and heavy equipment transported across sea ice would require thick, strong ice capable of supporting considerable additional weight, which would presumably ensure at most negligible impacts to the physical features of sea ice. Therefore, we conclude impacts to the physical features of sea ice due to vehicular traffic would be insignificant, and we do not evaluate this hypothetical threat further.

Based on the RFD, it is also plausible that oil or other petroleum products could be spilled during vehicular transport across sea ice, from vessels crossing marine waters within the boundaries of the sea ice unit during summer, when ice is broken or absent, or in terrestrial habitats within the Program Area, possibly allowing spilled oil to be transported into the sea ice unit by fluvial waters or other means. If spills were incompletely remediated, oil or other petroleum products could contaminate sea ice after freeze up in fall/winter. Spilled products could also affect ice seals, which are an identified component of sea ice habitat for polar bears. Finally, vehicular traffic on sea ice or in marine waters within the boundaries of the unit could conceivably disturb ice seals, potentially affecting fecundity or survival.

As with our evaluation of other effects of the Program, uncertainty regarding specific activities to be proposed and conducted prevents precise quantitative analysis of impacts to the Sea Ice Unit of critical habitat. Nonetheless, the same factors that serve to minimize effects of the action to polar bears would also apply to effects of the action on the Sea Ice Unit of critical habitat. Although the discussions above provide more detail, we find that Lease Stipulation 1 (protective corridors along selected rivers and streams) would reduce the risk of spilled oil reaching marine waters, and Lease Stipulation 4 (prohibiting exploration, production, and processing of oil in

coastal waters, lagoons and barrier islands) reduces the risk of oil and other petroleum products being spilled in marine waters.

More importantly, PDCs 1-4 further reduce the potential for impacts to sea ice critical habitat. Specifically, PDCs 3 and 4 would enhance the conservation benefits accrued during step-down section 7 consultations to be conducted on future activities proposed under the Program. Further, and most importantly, PDCs 1 and 2 (also Lease Notices 1 and 2) require that protections of the ESA and MMPA would be applied to all activities proposed under the Program. Notably, Lease Notices 1 and 2 apply to polar bears but also ringed and bearded seals, ensuring that impacts to polar bears, polar bear critical habitat, and their primary prey species will be subject to the protective benefits of these Lease Notices and PDCs. In summary, we conclude that potential impacts to sea ice habitat caused by spilled oil or other petroleum products, and potential impacts to ice seals caused by spills and/or disturbance, would be effectively managed under the regulatory protections of the ESA and MMPA. These regulatory protections would be co-administered by three Federal Agencies (BLM, NMFS, and the Service), required under two Federal legal authorities (MMPA and ESA), and repeatedly re-evaluated to ensure compliance with the MMPA and section 7(a)(2) of the ESA.

8.6.2 Unit 2, Terrestrial Denning Habitat

Terrestrial Denning Habitat comprises roughly 3,620,558 total acres, 1,193,600 acres (~33 percent) of which occurs within the Program Area (BLM 2019). When designating polar bear critical habitat, we "determined that terrestrial denning habitat includes the following features essential to the conservation the species: coastal bluffs and river banks with (a) steep, stable slopes (range 15.5 – 50.0 degrees), with heights ranging from 1.3 to 34 meters (4.3 to 111.6 feet), and with water or relatively level ground below the slope and relatively flat ground above the slope; (b) unobstructed, undisturbed access between den sites and the coast; (c) sea ice in proximity of terrestrial denning habitat prior to the onset of denning during fall to provide access to terrestrial den sites; and, (d) the absence of disturbance from humans and human activities that may attract other bears (75 FR 76086 – 76137)."

We identify no mechanisms by which the Proposed Program would affect the availability of sea ice proximal to terrestrial denning habitat. (Note that greenhouse gas emissions resulting from consumption of petroleum produced at particular drilling sites are not considered effects of production; Service Policy Memorandum dated May 14, 2008). Therefore, in this evaluation we will discuss possible impacts to banks that comprise suitable denning habitat, and disturbance of polar bears, which could dissuade or obstruct movements of females between den sites and the coast, or could attract non-denning bears to denning habitat.

When considering potential impacts of the Proposed Program to the physical characteristics of terrestrial denning habitat (banks with suitable macrohabitat features), it is important to note that there have been several situations in which polar bears have denned, usually successfully, in snow drifts formed by abandoned or even active industrial infrastructure in the Beaufort Sea region of Alaska. Examples include eight dens in nine years on the margins of an abandoned gravel pad about 4.3 miles (7 km) northeast of Milne Point CPF (USFWS unpublished data), and individual successful dens (i.e., females abandoned dens with cubs naturally) on an industrial island under construction (USFWS 2012); on ENI's Spy Island Development (Burke 2011); on an abandoned exploration gravel pad on Cross Island; on a runway ramp at the Bullen Point

Long-range Radar Site (USFWS 2012); along an active road causeway (DeMarban 2017); and under a bridge at Endicott Island at Prudhoe Bay (USFWS 2017b).

These examples illustrate that whether or not industrial facilities would affect the physical characteristics of denning habitat, preventing its future use for denning, would likely vary with the situation. Some facilities, such as gravel mine sites, large pads with CPFs and other large structures would presumably preclude maternal denning by polar bears, but it is difficult to separate the effects of changes to the landscape from the effects of human presence and activities in rendering the habitat unsuitable. Regardless, those facilities would account for a very small proportion of the Program Area, and an even smaller proportion of polar bear critical habitat.

As with evaluating potential effects of the Proposed Program to polar bears and other units of critical habitat, uncertainties regarding the nature, location, and timing of future activities proposed under the Program prevent precise quantitative analysis of potential effects to terrestrial denning habitat. Therefore, our analysis again relies on factors built into the Proposed Program that serve to minimize potential effects to terrestrial denning habitat, including impacts to the physical characteristics of denning habitat, and impacts to polar bear behaviors that could affect their access or exploitation of denning habitat. Public Law 115-97 limits the area that would be covered by production and support facilities to 2,000 Federal acres.

Lease stipulations 1 and 9 associated with Alternative B would reduce potential for effects to suitable denning habitat by providing setbacks for facilities along 10 rivers or creeks, and in areas within 2 miles of the coast; and would require conflict avoidance and monitoring plans to minimize impacts to polar bear movements and habitat within 2 miles of the coast. Additionally, PDCs 3 and 4 describe and strengthen the process that the BLM and the Service would use when implementing the programmatic framework consultation. Further, PDC 1 reiterates the BLM's commitment that activities under the Proposed Program would not be approved until applicable requirements of the ESA are met. This ensures that step-down section 7 consultations would be conducted on any activities that may affect polar bears or their critical habitat, and ensures that individual activities and the program as a whole must remain in compliance with section 7(a)(2).

Also importantly, PDC 2 requires compliance with the MMPA, including potential impacts to terrestrial denning habitat, and impacts to behaviors that influence polar bear access to, and use of, denning habitat. First, when issuing ITRs which authorize incidental take of polar bears under the authority of section 101(a)(5) of the MMPA, the ITRs must include "means of effecting the least practicable adverse impact upon the species or stock and its habitat." This provision requires, where appropriate, mitigation measures in LOAs to protect important features of habitat. Second, ITRs are not promulgated under the MMPA until disturbance of polar bears caused by the activities being considered is adequately evaluated and mitigated. For example, the current Beaufort Sea ITRs west of the Program Area included analysis of whether industry facilities act as physical barriers that obstruct polar bear movements, and concluded these facilities appear to present "only a small-scale, local obstruction" to movements (81 FR 52293). Further, LOAs issued under the existing ITRs carry conditions that include, but are not limited to, "measures to protect pregnant polar bears during denning activities (e.g., den selection, birthing, nurturing of cubs, and departing the den site;" 81 FR 52278). Similar measures would likely be applied in future ITRs such as any developed for the Action Area. Finally, prior to issuing LOAs allowing incidental take and/or intentional take of polar bears under the deterrence program, applicants must provide and receive approval of, a project-specific polar bear safety, awareness, and interaction plan that includes "a food, waste, and other 'bear attractants' plan."

We conclude that MMPA compliance would result in: 1) protection of the physical characteristics of terrestrial denning habitat by requiring measures to effect the least practicable impact upon the species or stock and its habitat, 2) careful evaluation and minimization of disturbance, including both behavioral interruption and physical obstruction of movements, and, 3) evaluation and approval of project-specific polar bear interaction plans to ensure that non-denning bears are not attracted to terrestrial denning habitat.

8.6.3 Unit 3, Barrier Islands

When designating critical habitat for polar bears, the Service identified barrier islands as a "physical feature essential to the conservation of polar bears in the United States." The unit was described as "barrier island habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal den and optimal feeding habitat, which includes all barrier islands along the Alaska coast, and their associated spits, within the range of the polar bear in the United States, and the water, ice, and terrestrial habitat within 1.6 kilometers (1 mile) of these islands (no-disturbance zone)" (75 FR 76086 – 76137). Unit 3, Barrier Island Habitat comprises roughly 2,613,139 total acres along the Alaska coast within the range of the polar bear. The BA (BLM 2019) estimated approximately 1,400 acres of Unit 3 occur within the Program Area[19].

Based on the description of barrier islands at designation, we consider the physical feature of barrier islands to include the physical characteristics of islands, accompanied by refuge from disturbance necessary for denning, resting, and unimpeded movements. In this light, we consider potential impacts of the proposed RFD to barrier island habitat to include construction of facilities on barrier islands, human activities on, near, or over barrier islands that could disturb or impact use by polar bears, and the risk of spills of oil or other petroleum products reaching barrier islands.

As with other effects of the action, uncertainty regarding future activities that would be proposed under the Program prevents precise quantitative analysis of impacts to the Barrier Island Unit of critical habitat. Nonetheless, there is considerable overlap in the importance of the same factors that serve to minimize other effects of the action. Specifically, Lease Stipulation 4 prohibits "exploratory well drill pads, production well drill pads, or a CPF for oil and gas" on barrier islands. Although Lease Stipulation 4 does reference a process through which the BLM, after consultation with the Service (and/or NMFS, as appropriate), may approve "infrastructure necessary for oil and gas activities in these critical and sensitive coastal habitats, such as barge landing, docks, spill response staging and storage areas, and pipelines," such activities are not currently permitted under the Proposed Program Therefore, this stipulation prevents exploration,

[19] It is important to note that barrier islands frequently shift in extent, location, and shape. In fact, the current location and extent of barrier islands used to define the northern boundary of the Program area are misaligned with the maps of barrier islands used to define and depict the critical habitat unit at the time of designation. We note that this misalignment has caused substantial imprecision in the estimate of the overlap between designated critical habitat and the Program area. This however, does not affect the obligation to evaluate the effects of the proposed

action on critical habitat, including Unit 3, for compliance with the MMPA and ESA.

production, and processing of oil on barrier islands, and would require interagency consultation prior to authorizing construction of other facilities that could affect polar bears, their habitat, or their prey.

In regard to the risk of spilled oil or other petroleum products reaching barrier islands, we find that Lease Stipulation 4 (prohibiting exploration, production, and processing of oil in coastal waters, lagoons and barrier islands) also reduces the risk of oil and other petroleum product spills in marine waters. Lease Stipulation 1 (protective corridors along selected rivers and streams) would reduce the risk of oil spilled in terrestrial areas being transported to the marine environment by fluvial waters.

Additionally, and more importantly, PDCs 1-4 serve to reduce potential impacts to barrier island habitat. PDCs 3 and 4 enhance the conservation benefits accrued during future step-down section 7 consultations on activities proposed and/or authorized under the Program. Further, and most importantly, PDCs 1 and 2 require that protections of the ESA and MMPA be applied to all activities proposed under the Program. In summary, we conclude that potential impacts to barrier island habitat, caused by construction of facilities on barrier islands, disturbance on or within 1 km of barrier islands, and the risk of spilled oil or other petroleum products reaching barrier islands, would be effectively managed under the regulatory protections of the MMPA.

9. CUMULATIVE EFFECTS

Under the ESA, cumulative effects are the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the Action Area considered in this BO. However, future Federal actions are not considered because they will require separate consultation under the ESA. It is also important to note that cumulative effects will also be assessed and updated each time a step down section 7 consultation is developed pursuant to this programmatic consultation. These step down consultations will provide a real time assessment of cumulative effects when an activity is proposed. However, it is likely that the following types of activities may occur in the action area in the future, and their potential cumulative effects pursuant to the ESA are considered here.

Oil and Gas Development
Oil and gas development, whether in Federal or State waters or in the terrestrial environment on State, private, Native-owned, or Federal lands, would require Federal permits (e.g., section 404 of the Clean Water Act authorization from the U.S. Army Corps of Engineers [USACE], and National Pollution Discharge Elimination System permits from the Environmental Protection Agency) and, therefore, are not considered cumulative impacts under the ESA.

Community Growth
While many communities on the North Slope are growing, the population of Kaktovik is relatively stable going from 239 in the 2010 census to an estimated 256 in 2018 (U.S. Census data accessed at www.census.gov). As populations increase so do community footprints, along with associated infrastructure such as roads, powerlines, communication towers, landfills, and gravel pits. The scale of potential adverse impacts will depend not only on the amount of

growth, but the location as it relates to eider nesting habitat. However, the area around Kaktovik and the majority of the terrestrial Action Area is classified as wetlands (https://www.fws.gov/wetlands/data/mapper.html). Therefore, a section 404 permit from the USACE would likely be necessary for any large scale community development projects. The issuance of these permits would also trigger consultation under the ESA. Smaller projects may not require a Federal permit, but are also likely to have a smaller, if any, impact to listed eiders.

As the population of North Slope communities increases so does the number of subsistence hunters. This could adversely affect listed eiders through direct shooting of these birds and contamination of habitat if lead shot is illegally used. However given that few listed eiders are present in the Action Area and both the harvest and use of lead shot for waterfowl hunting is illegal, significant impacts are not anticipated.

Similarly, as populations of Arctic coastal communities increase, so does the probability of human-polar bear encounters, and/or subsistence harvest of polar bears. Since 2010, USFWS has provided funding and technical support to the North Slope Borough for implementing a Polar Bear Patrol program in rural communities, including Kaktovik. This program has been successful, and provides critical safety coastal communities and has contributed to polar bear conservation by repeatedly deterring polar bears from the village without having to use lethal methods (Miller et al. 2018). This program will likely continue into the future, but the impact of any changes to the Program will also be evaluated in future step-down consultations.

Commercial fishing

Reduction in the extent and duration of sea ice may increase the potential for commercial fishing within the MTR portion of the Action Area, but the likelihood and magnitude of these activities are unknown at this time. Future commercial fisheries in the action area would likely be managed by the National Marine Fisheries Service, and the issuance of regulations would require section 7 consultations, and are therefore not considered cumulative effects.

Increased Marine Traffic

As the extent of arctic sea ice in the summer has declined, and the duration of ice free periods has increased, interest in shipping within and through arctic waters has increased (Brigham and Ellis 2004). Increased shipping along the Northern Sea Route (part of the Northeast Passage that follows Norway and Russia's coast down into the Chukchi and Bering seas), and the Northwest Passage (which follows Canada's eastern coast north along Canada and Alaska's Beaufort Sea coast) could result in increased fragmentation of sea ice habitat and disturbance/injury to marine mammals, increased human-bear encounters, and the introduction of waste/litter, and toxic pollutants, including spilled oil (PBRS 2015). All of these threats could potentially affect polar bears and listed eiders.

The Arctic Council conducted a comprehensive Arctic marine shipping assessment for the Arctic Ocean, focusing on potential impacts on humans and the arctic environment (AMSA 2009). The AMSA Report includes a comprehensive estimate of the number of ships (excluding naval vessels) operated in the Arctic by year, and identified Arctic natural resource development and regional trade as the key drivers of future Arctic marine activity. The release of oil was identified as one of the most significant environmental threats related to shipping. The report specifically recommended that Arctic countries address impacts on marine mammals from shipping, and work with the International Maritime Organization (IMO) to develop and implement mitigation strategies.

Since then, significant advances have been made in implementing recommendations set forth in the AMSA Report. For example, several reports that identify Arctic marine areas of special ecological and cultural importance have been published (Smith et al. 2010), and voluntary guidelines to reduce underwater noise to avoid adverse impacts on marine biota have been developed (PAME 2015). Additionally, vessel routing and speed restrictions have been recognized as effective measures to mitigate impacts on marine mammals (Brigham and Sfraga 2010). In 2015, the IMO adopted the environmental provisions of the Polar Code, which include standardized safety procedures addressing design, construction, equipment, operational, training, environmental protection standards, and use of designated shipping lanes. The Polar Code was entered into force on January 1, 2017 (IMO 2019).

Increased Scientific Research
Scientific research across the Arctic is increasing as concern about effects of climate change in the arctic grows. While research is often conducted by universities and private institutions, these activities will require permit authorizations from Arctic Refuge, or from the BLM if scientific activities are related to oil and gas development. Based on recent figures the Arctic Refuge estimates < 20 scientific research permits would be issued each year (Josh Rose, Arctic Refuge, Pers. Comm.). Large scale projects in the marine environment along the MTR are generally funded by the National Science Foundation or operate off USCG ice breaking vessels. These activities have been and/or will be considered in separate section 7 consultations.

Recreation
All commercial guiding or outfitters operating in the Arctic Refuge require commercial use permits. In 2017, four commercial air service operators provided air taxi service for 1,400 Refuge visitors; another seven operators chartered polar bear viewing excursions for 1,600 visitors. Air taxi service supported recreation for 850 river floaters, 300 backpackers, 40 base campers, and 100 hunters (BLM 2018b). Visitor use in the Program Area has increased in recent years with the emergence of polar bear viewing on waters immediately surrounding Kaktovik. Before the season for polar bear viewing, more than 90 percent of visitors access the Program Area via airplane, with more than 80 percent of all visitors arriving via chartered planes (Christensen and Christensen 2009). Other visitors accessed recreation opportunities in the program area via boat or on foot.

Activities that involve the use of guides or commercial air operations for access or egress to the Refuge are subject to refuge permitting requirements and therefore are not cumulative effects under the ESA. In contrast, purely private actions within the Refuge or on private lands within or adjacent to the Refuge but within the Coastal Plain meet the definition of cumulative effects under the ESA. Visitors to the Refuge or users of nearby private lands could disturb a few individual listed eiders each year but eiders occur at such low density that we believe the likelihood of encounters or impacts is very low. As polar bears become more common onshore during summer and fall, there is potential for increased human–polar bear interactions, including in the Refuge and on nearly private lands. In response, Refuge managers are developing a programmatic section 7 consultation to monitor impacts and develop ways to avoid and minimize impacts on polar bears as needed. Similarly, we anticipate that local leaders in Kaktovik will continue to improve oversight of polar bear viewing activities on private lands near the village, including management of subsistence carcasses and deterrence actions used to protect human safety and minimize conflict. We anticipate that these efforts by Refuge managers and local leaders will continue to increase commensurate with changes in impacts to polar bears and risk to village residents and visitors, regardless of whether the underlying human activities are purely private or subject to Federal permitting requirements

Conclusion
In summary, we anticipate the scope and scale of oil and gas development, community growth, scientific activities, and recreation in the Action Area will continue, and may increase in the future. Most notably, activities with potential to affect significant numbers of individuals of listed species (such as oil and gas development and community growth) are expected to require consultation under the ESA; whereas those that may not require consultation (e.g., small projects in developed areas such as home renovation) will likely have at most minor impacts to listed species or will entail responsible oversight by local leaders.

10. CONCLUSION

This section provides our opinion regarding whether the effects of the Proposed Program are likely to jeopardize listed species or result in the destruction or adverse modification of critical habitat. We considered the potential effects of the Program as a whole, while recognizing that specific actions and activities that would be proposed under the Program remain uncertain. Therefore, we conducted a framework programmatic consultation, which required the identification of potential program effects and the development of guidelines to minimize effects to listed species and critical habitat. Thus, "step-down" consultations would be required when specific actions and activities are proposed and project-specific information is provided, and we defer enumeration and authorization of incidental take until that time.

Our opinion as to whether the action is likely to jeopardize listed species or result in the destruction or adverse modification of critical habitat was formulated by adding the effects of the action and cumulative effects to the environmental baseline, in light of the status of the species and critical habitat. These determinations were made by applying regulations (50 CFR 402.02) that implement section 7(a)(2) of the ESA and define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." "Destruction or adverse modification of critical habitat" is defined as a "direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species."

We note that we determined that the Proposed Program is not likely to adversely affect the southwest Alaska DPS of northern sea otters or critical habitat for northern sea otters, spectacled eiders, or Alaska-breeding Steller's eiders. Therefore, we do not revisit or provide conclusions for sea otters or critical habitat for sea otters, spectacled eiders, and Steller's eiders here.

10.1 Spectacled eiders

In evaluating impacts of the RFD to listed eiders, we identified potential adverse effects from long-term habitat loss, disturbance, and collisions. Using methods explained in the *Effects of the Action* section, over the 135-year life of the Program, we estimate:

- Loss of production from 35 nests due to long-term habitat loss and associated disturbance;
- Loss of production from 25 nests from on-tundra aircraft operations; and,
- Loss of a total of 17 adult or fledged juvenile spectacled eiders from collisions attributed to the RFD (5 due to collisions with structures and 12 due to collisions with vessels).

We acknowledge these estimates could change as the species' status changes over the Program's duration, and specific details of actions and activities are identified. Therefore, re-evaluation during step-down consultations will be necessary. Nonetheless, because 1) this estimate is based on the best information currently available, 2) this loss would occur over an estimated 135-year Program, and 3) the overall estimated loss is a small proportion of the estimated North Slope-breeding population of spectacled eiders (13,501–16,128, 90% CI; Stehn et al. 2013); we believe spectacled eider loss that may result from the Proposed Program would not significantly affect the likelihood of survival and recovery of this species. Therefore, after reviewing the current status of spectacled eiders, the environmental baseline for the action area, the effects of the Proposed Program, and the cumulative effects, it is the Service's biological opinion that the Program, as proposed, is *not likely to jeopardize the continued existence* of spectacled eiders by reducing appreciably the likelihood of survival and recovery in the wild by reducing reproduction, numbers, or distribution of this species.

10.2 Steller's eiders

In evaluating impacts of the proposed RFD to Steller's eiders, the Service identified potential adverse effects from collisions with vessels. Using methods explained in the *Effects of the Action* section, the Service estimates potential loss of 1 adult and or fledged juvenile Steller's eider over the life of the project. Given that this loss would occur over an estimated 135-year Program, and the estimated loss is a small proportion of the estimated population of Alaska-breeding Steller's eiders (292-859, 90% CI; Stehn and Platte 2009), we believe Steller's eider loss that may result from the Proposed Program and associated RFD, would not significantly affect the likelihood of survival and recovery of this species. Therefore, after reviewing the current status of Steller's eiders, the environmental baseline for the action area, the effects of the Proposed Program, and the cumulative effects, it is the Service's biological opinion that the Program, as proposed, is *not likely to jeopardize the continued existence* of Alaska-breeding Steller's eiders by reducing appreciably the likelihood of survival and recovery in the wild by reducing reproduction, numbers, or distribution of this species.

10.3 Polar bears

In evaluating impacts of the Proposed Program to polar bears, we have identified potential adverse effects from disturbance, human-polar bear interactions, spills of oil and other petroleum products, and impacts to prey. Quantifying these effects is very difficult given uncertainties regarding the nature, location and timing of future oil and gas activities that would be proposed under the Program, coupled with likely future changes in the status, abundance, and distribution

of polar bears in response to deteriorating arctic sea ice. Nevertheless, we performed a qualitative impacts analysis based on the RFD, which provided reasonable projections for the Proposed Program in the future, and our past experience evaluating and regulating analogous oil and gas activities in other portions of the Beaufort Sea region.
We find that a host of exploration, development, production, and decommissioning activities associated with the Proposed Program would intermittently incidentally expose small numbers of polar bears of the SBS stock to disturbance, and that such impacts would recur over time as additional Proposed Program-related activities proceed. We also find that most of those exposures would not be biologically significant. The spatial and temporal distance between disturbance events would limit the potential for impacts to be biologically significant to individual bears and further reduce the potential for biologically significant impacts to individual bears to compound to effects at the stock level, let alone the species level. We acknowledge the Proposed Program-related activities could affect an increasingly higher proportion of the SBS stock of polar bear in the future (due to polar bears' increased use of terrestrial areas as sea ice decreases, a decline in the SBS stock population, or other factors). We also acknowledge that polar bears in the action area could become increasingly sensitive to disturbance or other impacts due to food stress or other factors indirectly associated with climate change. Regardless, we anticipate that the activities authorized under the Proposed Program would continue to impact small numbers of individual polar bears within the SBS stock and would not appreciably affect the survival and recovery of the polar bear species as a whole. When considering effects from the Proposed Program in combination with cumulative effects, we arrive at a similar conclusion because any such activities with the potential for significant effects are likely to have a federal nexus and therefore will require a separate section 7 consultation. Other smaller scale activities, which may not have a federal nexus, are likely to have smaller impacts and therefore would not make a significant contribution to cumulative effects. It is important to note these smaller scale activities are likely to still be managed locally and by the Arctic National Wildlife Refuge.

Our analysis also finds that several aspects of the Proposed Program would serve to limit its potential for associated oil and gas development actions and activities to impact polar bears. Key protections inherent in the Project Description include: the spatial limit on the footprint of production and support facilities on Federal lands; lease stipulations which prohibit, restrict, or discourage disruptive activities in areas where polar bears are more likely to be present (i.e., coastal waters, coastal areas, lagoons, barrier islands, river and stream corridors); and required operating procedures that prescribe safe and environmentally responsible methods for conducting oil and gas activities.

Another key protection built into the Proposed Program is the BLM's commitment, as expressed through PDC 2 and Lease Notice 2, to not approve any exploration or development activity with the potential to take polar bears unless the applicant/operator applies for relevant take authorizations under the MMPA, and provides documentation of compliance. The burden to seek authorization for take under the MMPA typically falls solely upon the parties proposing to engage in activities that would result in take. For this Program, however, the BLM has taken the step of requiring applicant/operators to apply for an MMPA take authorization for any activity that may cause take of marine mammals, and to show compliance with the MMPA. This is important because proposed activities must meet several protective standards in order to qualify for an MMPA incidental take authorization. The Service may not grant such an authorization unless it finds that the activity would take only a small number of polar bears, would cause no more than a "negligible impact" to the SBS stock of polar bears, and would not have an "unmitigable adverse impact" on the availability of polar bears for subsistence uses. As explained in more detail above, the requirement to find "negligible impact" at the SBS stock scale (which is one of 19 subpopulations comprising the species) applies a more protective standard than the jeopardy standard under the ESA, which is evaluated at the broader species scale. If the incidental take associated with an action meets the MMPA standard of negligible impact to the stock, there should be little potential for the incidental take from that action to jeopardize the continued existence of polar bears as a species. Because activities authorized under the Proposed Program would either (a) not result in incidental take of polar bears, or (b) would result in the incidental take of a small number of polar bears from the SBS stock, it follows that the Proposed Program has little potential to jeopardize the polar bear species.

In conclusion, we find that the Proposed Program contains protective measures that provide a significant conservation benefit for polar bears by effectively limiting the capacity of Program-related oil and gas exploration or development activities to cause adverse effects. We expect that the spatial limit on development, lease stipulations protecting areas more highly utilized by polar bears will limit the potential for the Proposed Program to negatively impact polar bears. We also expect that the requirement to obtain MMPA incidental take authorization prior to engaging in any activity that may take polar bears will help ensure that Program-related impacts remain negligible, even at the stock level, as opposed to the species level at which the potential for "jeopardy" is evaluated.

Based on these factors, and after reviewing the current status of polar bears, the environmental baseline for the action area, the effects of the proposed Program, and the cumulative effects, it is the Service's biological opinion that the Program, as proposed, is *not likely to jeopardize the continued existence* of polar bears by reducing appreciably the likelihood of survival and recovery in the wild by reducing reproduction, numbers, or distribution of this species.

We further note that additional consultations required under the framework programmatic approach applied to this Proposed Program will help ensure that the Program remains complaint with section 7(a)(2) going forward. The BLM and the Service will conduct step-down consultations on all future activities proposed and authorized under the Program that may affect listed species or designated critical habitat. This is required in all framework programmatic consultations but has been intentionally strengthened and reiterated through PDC 1 (which also comprises Lease Notice 1), and PDCs 3 and 4, which are additional procedures to be used to ensure adequacy of the future consultation process. Meanwhile, intra-Service consultations would also be required prior to the issuance of any incidental take authorizations under the MMPA. These future consultations would result in repeated evaluation of the effects of the Program, each based on project-specific information, updated species status and environmental data, and an increased understanding of how oil and gas activities in the Coastal Plain of the Arctic Refuge affect polar bears. These consultations would also provide additional opportunities to integrate the ESA and MMPA regulatory processes to better address the conservation needs of the polar bear and ensure the Program remains in compliance with applicable Federal laws.

10.4 Polar bear critical habitat

In evaluating impacts of the Proposed Program to polar bear critical habitat, we separately considered potential effects of the Proposed Program to all three units, which are Sea Ice, Terrestrial Denning, and Barrier Island habitat. For all three units, we evaluated potential adverse effects to the physical and biological features of the habitat. For the Terrestrial Denning and Barrier Island units, we also evaluated the potential for human presence and activities to affect the value of critical habitat through disturbance, which could dissuade use or prevent access. As with analyzing effects to polar bears, we found that evaluating impacts of the Proposed Program to polar bear critical habitat is difficult due to uncertainties regarding the nature, location and timing of oil and gas activities that would be proposed under the Proposed Program. Nevertheless, we analyzed impacts qualitatively based on the RFD, which provided reasonable projections about the potential nature of future oil and gas exploration and development, and our past experience evaluating and regulating analogous oil and gas activities in other portions of the Beaufort Sea region. A summary, by unit, of the considerations that informed our conclusions follows.

Unit 1, Sea Ice Habitat

When designating polar bear critical habitat, we determined sea ice that moves or forms over shallower waters of the continental shelf and that contains adequate prey resources (primarily ringed and bearded seals) to support polar bears is an essential physical feature for polar bears in the southern Beaufort, Chukchi, and Bering seas (as described in more detail in Effects of the Action). Although there is little overlap between the Program Area and Unit 1, we identified that activities resulting from the proposed Program could potentially affect this essential physical feature through three mechanisms: 1) damage to the physical characteristics of sea ice caused by vehicular travel across ice, 2) spills of oil or other petroleum products into marine waters that form ice, or directly onto ice, and, 3) impacts to ringed and bearded seals, caused by disturbance or spills of oil or other petroleum products.

Uncertainty regarding specific actions and activities to be proposed and conducted prevents precise quantitative analysis of impacts to the Sea Ice Unit of critical habitat. Nonetheless, the same factors that serve to minimize effects of the action to polar bears would also apply to effects of the action on the Sea Ice Unit of critical habitat. Lease Stipulation 4 generally prohibits surface occupancy of any leases within coastal waters, lagoons, or barrier islands, thus limiting the potential that the physical characteristics of sea ice would be damaged by oil and gas infrastructure, much less associated vehicle travel (which by its nature would only cause insignificant impacts). While the BLM could still approve certain necessary infrastructure (i.e. barge landings, docks, spill response and staging and storing areas, and pipelines) in these areas within or near sea ice habitat, it could only do so on a case-by-case basis after consultation with USFWS and NMFS, and the footprint and degree of disturbance associated with such infrastructure would be limited. Lease Stipulation 4 and Lease Stipulation 1 (protective corridors along selected rivers and streams) would also reduce the risk of oil or other petroleum products spilled in the terrestrial environment reaching marine waters. These constraints on potential oil and gas activities would serve to limit potential disturbance- and spill-related impacts to polar bears as well as to the ringed and bearded seals on which they prey.

Meanwhile, PDC 2 and Lease Notice 2 would require MMPA compliance for actions and activities to be authorized under the Program. This would ensure impacts to polar bears and their habitat, including sea ice, along with ringed and bearded seals, would be considered on a project-specific basis prior to authorizing any oil and gas activities that may take marine mammals in or near sea ice. The substantive standards imposed by the MMPA as a prerequisite to issuing incidental take authorizations (i.e., small numbers of take, negligible impacts to the stock, and no unmitigable adverse impact on the availability of the stock for subsistence uses), as well the requirement that any such authorization include "means of effecting the least practicable adverse impact upon the species or stock and its habitat," provide further assurance that the polar bear's Unit 1 habitat would not be appreciably diminished.

Unit 2, Terrestrial Denning Habitat
When designating polar bear critical habitat, we determined that terrestrial denning habitat includes the following features essential to the conservation the species: coastal bluffs and river banks with (a) steep, stable slopes with water or relatively level ground below the slope and relatively flat ground above the slope; (b) unobstructed, undisturbed access between den sites and the coast; (c) sea ice near terrestrial denning habitat prior to the onset of denning during fall to provide access to terrestrial den sites; and, (d) the absence of disturbance from humans and human activities that may attract other bears (75 FR 76086 – 76137).

We identified that activities resulting from the Proposed Program could potentially affect these essential physical features by impacting banks that comprise suitable denning habitat, and by disturbing polar bears, which could affect movements of females between den sites and the coast, or by attracting non-denning bears to denning habitat. We identified no mechanisms by which the Proposed Program would affect the availability of sea ice proximal to terrestrial denning habitat.

We find two factors that reduce the potential for the Proposed Program to affect the physical features of banks to the extent that denning is discouraged. First, it is not apparent, based on the history of the oil and gas industry in the Beaufort Sea region, that oil and gas infrastructure reduces the habitat's capacity to support denning. There are a number of cases of polar bears denning, usually successfully, in drifts created in the lee of infrastructure. Therefore, the degree to which the presence of structures would affect the value of denning habitat is unknown (although human presence and activities associated with structures is known to affect the use of habitat).

Second, several restrictions built into the Proposed Program would serve to minimize the likelihood that infrastructure would be built where it would affect suitable denning habitat. Public Law 115-97 limits the area that would be covered by production and support facilities to 2,000 Federal acres, which pre-emptively limits the amount of terrestrial denning habitat that could be directly affected. Meanwhile, two lease stipulations would effectively steer the siting of infrastructure away from suitable denning habitat that exists in the Program Area (there is < 0.4 percent overlap between suitable terrestrial denning habitat and the Program Area). Lease stipulation 1 would reduce potential effects to suitable denning habitat by prohibiting surface occupancy by permanent oil and gas facilities including gravel pad, roads, airstrips, and pipelines within specified streambeds and within a prescribed setback distance of either 1 mile or 0.5 miles. This is important because much of the terrestrial denning habitat available within the Program Area exists within these NSO zones. Lease Stipulation 9 would further require that, prior to beginning exploration or development within 2 miles of the coast (another area containing a relatively higher degree of terrestrial denning habitat compared with the Program Area as a whole), the lessee/operator/contractor must develop a conflict avoidance and monitoring plan to assess, minimize and mitigate the effects of any infrastructure and its use on polar bear habitat (among other resources).

We also find that the project-specific reviews that would occur under the framework programmatic approach guiding this Proposed Program would enable lessees, the BLM, and the Service to effectively site the inherently limited amount of facilities away from any discrete suitable denning habitat that exists in portions of the Program Area not subject to NSO or conflict avoidance requirements.

PDC 2 and Lease Notice 2 reinforce this expectation by requiring compliance with the MMPA and its substantive standards (i.e. small numbers, negligible impacts to the stock, etc.). MMPA incidental take authorizations must also include "means of effecting the least practicable adverse impact upon the species or stock and its habitat" and would entail, as needed, mitigation measures to protect important features of habitat. We find that PDC 2 and Lease Notice 2 provide the mechanism and requirement that siting decisions protect the physical features of suitable terrestrial denning habitat. These requirements also provide further assurances that disturbance of polar bears, which could affect movements of females between the coast and denning habitat, and/or attract non-denning polar bears to denning habitat, would be effectively managed.

The current Beaufort Sea ITRs that apply to the oil and gas industry operating west of the Program Area are instructive in this regard. The ITRs include analysis of whether industry facilities act as physical barriers that obstruct polar bear movements, and concludes these facilities appear to present "only a small-scale, local obstruction" to movements (81 FR 52293). Further, LOAs issued under the existing ITRs carry conditions that include, but are not limited to, "measures to protect pregnant polar bears during denning activities (e.g., den selection, birthing, nurturing of cubs, and departing the den site;" 81 FR 52278). Similar measures would likely be applied in future incidental take authorizations developed for the Action Area. Finally, prior to authorizing incidental take and/or intentional take of polar bears under the deterrence program, applicants must provide and receive approval of, a project-specific polar bear safety, awareness, and interaction plan that includes "a food, waste, and other 'bear attractants' plan."

Thus, MMPA compliance would result in: 1) protection of the physical characteristics of terrestrial denning habitat by requiring measures to effect the least practicable impact upon the species or stock and its habitat, 2) careful evaluation and minimization of disturbance, including both behavioral interruption and physical obstruction of movements, and, 3) evaluation and approval of project-specific polar bear interaction plans to ensure that non-denning bears are not attracted to terrestrial denning habitat.

In sum, we expect that limitations inherent to the Proposed Program, including the requirement to comply with the MMPA, will serve to preclude oil and gas activities from appreciably diminishing the value of Unit 2 of polar bear critical habitat as a whole.

Unit 3, Barrier Islands

When designating critical habitat for polar bears, the Service identified barrier islands as a "physical feature essential to the conservation of polar bears in the United States." The unit was described as "barrier island habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal den and optimal feeding habitat, which includes all barrier islands along the Alaska coast, and their associated spits, within the range of the polar bear in the United States, and the water, ice, and terrestrial habitat within 1.6 kilometers (1 mile) of these islands (no-disturbance zone)" (75 FR 76086 – 76137).

Based on the description of barrier islands at designation, we consider the physical feature of barrier islands to include the physical characteristics of islands, accompanied by refuge from disturbance necessary for denning, resting, and unimpeded movements. In this light, we consider potential impacts of the proposed RFD to barrier island habitat to include construction of facilities on barrier islands, human activities on, near, or over barrier islands that could disturb or impact use by polar bears, and the risk of spills of oil or other petroleum products reaching barrier islands.

As with other effects of the action, uncertainty regarding future activities that would be proposed under the Program prevents precise quantitative analysis of impacts to the Barrier Island Unit of critical habitat. Nonetheless, there is considerable overlap in the importance of the same factors that serve to minimize other effects of the action. Specifically, Lease Stipulation 4 subjects leases with nearshore marine, lagoon, and barrier island habitats to NSO provisions which prohibit "exploratory well drill pads, production well drill pads, or a CPF for oil and gas" on barrier islands and surrounding areas. While Lease Stipulation 4 also allows a BLM Authorized Officer to approve "infrastructure necessary for oil and gas activities in these critical and sensitive coastal habitats, such as barge landing, docks, spill response staging and storage areas, and pipelines," the physical footprints and associated zones of disturbance of such facilities would be limited, and such facilities could only be approved on a case-by-case basis after consultation with the USFWS or NMFS or both, as appropriate. Therefore, this stipulation generally precludes exploration, production, and processing of oil from affecting barrier island habitat, and would require interagency consultation prior to authorizing construction of other, smaller facilities that could affect barrier island habitat, or the polar bears and polar bear prey that utilize these areas.

In regard to the risk of spilled oil or other petroleum products reaching barrier islands, we find that Lease Stipulation 4 (prohibiting exploration, production, and processing of oil in coastal waters, lagoons and barrier islands) reduces the risk of oil and other petroleum product spills in marine waters, and Lease Stipulation 1 (protective corridors along selected rivers and streams) would similarly reduce the risk of oil spilled in terrestrial areas being transported to the marine environment by fluvial waters.

It bears repeating that PDC 2 and Lease Notice 2 require that lessees demonstrate compliance with the MMPA. As for the other units of polar bear critical habitat previously discussed, this aspect of the Proposed Program would add to the conservation of the physical features of barrier islands resulting from the lease stipulations discussed above.

In sum, we expect that limitations inherent to the Proposed Program, including the requirement to comply with the MMPA, will serve to preclude oil and gas activities from appreciably diminishing the value of Unit 3 of polar bear critical habitat as a whole.

Determination

In conclusion, we find that the Proposed Program contains protective measures that provide significant conservation benefits for polar bear critical habitat by effectively limiting the capacity of Program-related oil and gas exploration or development activities to cause adverse effects. We expect that the spatial limit on development and lease stipulations that directly or indirectly protect areas more highly utilized by polar bears (e.g., offshore habitats, river corridors, and barrier islands) would limit the potential for the Proposed Program to negatively impact critical habitat. We also expect that the requirement to obtain MMPA incidental take authorization prior to engaging in any activity that may take polar bears will also contribute to the protection of critical habitat, directly by requiring means to effect least practicable impacts but also indirectly by minimizing disturbance, which could otherwise affect access to or use of critical habitat for denning, resting, or movements. Based on these factors, and after reviewing the current status of polar bear critical habitat, the environmental baseline for the action area, the effects of the proposed Program, and the cumulative effects, it is the Service's biological opinion that the Program, as proposed, is *not likely to destroy or adversely modify* polar bear critical habitat.

We further note that additional consultations required under the framework programmatic approach applied to this Proposed Program will help ensure that the Program remains compliant with section 7(a)(2) going forward. The BLM and the Service will conduct step-down consultations on all future activities proposed and authorized under the Program that may affect listed species or designated critical habitat. This is required in all framework programmatic consultations but has been intentionally strengthened and reiterated through PDC 1 (which also comprises Lease Notice 1), and PDCs 3 and 4, which are additional procedures to be used to ensure adequacy of the future consultation process. Meanwhile, intra-Service consultations would also be required prior to the issuance of any incidental take authorizations under the MMPA. These future consultations would result in repeated evaluation of the effects of the Program, each based on project-specific information, updated assessments of the status of critical habitat and environmental data, and an increased understanding of how oil and gas activities in the Coastal Plain of the Arctic Refuge could affect critical habitat. These consultations would also provide additional opportunities to integrate the ESA and MMPA regulatory processes to better address the conservation needs of the polar bear and its critical habitat to ensure the Program remains in compliance with applicable Federal laws.

11. **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information to be used in managing listed species. BLM is encouraged to:

1. Continue to monitor threatened eiders, polar bears, and BLM special status species in the Arctic Refuge. Results will allow the Service and BLM to better evaluate abundance, distribution, and population trends of listed eiders, polar bears, and other special status species. These efforts will enhance the likelihood that future oil and gas development within the Arctic Refuge will not jeopardize listed species, impact the conservation value of critical habitat, or increase the need to list additional species.
2. Work with the Service and other Federal and State agencies in implementing recovery actions identified in the Steller's and spectacled eider recovery plans and the Polar Bear Conservation Management Plan. Research to determine habitat requirements, sensitivity to disturbance and other program-related impacts, and response to current population threats is an important step toward minimizing conflicts with current and future North Slope oil and gas activities.

We request notification of the implementation of any conservation recommendations by the BLM to keep the Service informed of actions minimizing or avoiding adverse effects or benefiting listed species and their habitats.

12. **REINITIATION NOTICE**

As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and re-initiation may be required if:

1. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
2. The action is modified in a manner causing effects to listed or critical habitat designated that may be affected by the action; or
3. A new species is listed or critical habitat designated that may be affected by the action.

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APPENDIX A

Below we provide the approach and calculations used to estimate impacts to listed eiders resulting from collisions with barges associated with the RFD.

Listed eiders

As discussed in the *Environmental Baseline*, migratory birds suffer considerable mortality from collisions with anthropogenic objects. Listed eiders migrating east during spring and west during summer/fall would be at risk of colliding with barges in the marine environment. We expect most eiders would remain offshore during spring migration because they are thought to follow open water leads in pack ice during spring migration to breeding grounds (Woodby and Divoky 1982, Johnson and Richardson 1982, Oppel et al. 2009, M. Sexson, USGS, pers. comm.). During post-breeding migration in summer and fall, we anticipate male eiders would have the greatest collision risk in the action area. Satellite telemetry studies from the eastern ACP indicated male spectacled eiders depart early in summer and generally remain close to shore, sometimes crossing overland, during westward migration (TERA 2002; see also Petersen et al. 1999). When females and juveniles migrate during late summer/fall, decreasing daylight and frequent foggy weather conditions could increase collision risk. Longer nights increase the duration that eiders are vulnerable to collisions with unseen vessels, and may compound susceptibility to attraction and disorientation from vessel lighting. Overall, we anticipate risk of listed eider mortality from collisions with barges under the RFD would be low.

Nonetheless, using the best available information, we provide an estimate of collision risk for listed eiders from barging operations during the Program. We begin by calculating the risk of collision per barge operating during a single season in the Chukchi and Beaufort seas, based on observed eider (king and common) collisions during Royal Dutch Shell's 2012 Exploratory Program, and the estimated number of eiders migrating through the region. We then multiply the estimated collision rate (collisions per vessel per season) by the estimated abundance of spectacled and Steller's eiders within the action area. Next we approximate the number of collisions expected for listed eiders from an estimated total of 270[20] vessels, over the life of the Program. Finally, because barges would be expected to operate over a longer period each season than the duration of Shell's 2012 open-water campaign, we adjust the calculations to estimate collisions over an extended period of operations (approximately 150-days[21] of predicted open-water barging per season). These calculations are presented in detail below.

[20] BLM predicts an average of two barge transports per year (BLM 2018a). Therefore, over a 135-year Program, approximately 270 vessel trips would be expected.

[21] A typical open-water season is approximately 150 days. We expect the proposed barging operations would be of shorter duration (likely much shorter) than the length of a typical open-water season. We also acknowledge the timing of barge operations would be difficult to estimate with precision due to a number of factors including seasonal variation in sea ice conditions and marine forecasts. Therefore, lacking greater certainty in project timing, we have conservatively extrapolated our estimate to cover a full open-water season. We believe this represents an overestimation of collision risk to listed eiders. Furthermore, because appreciable collision risk to listed eiders is not expected despite this acknowledged overestimation, we expect actual collision risk to listed eiders may be considerably less than the level predicted.

Although limited, the best available information with which to estimate collision risk between marine vessels and migratory birds are observations recorded during Royal Dutch Shell's (Shell) exploratory oil and gas activities in 2012. Ten vessels operating in the Chukchi Sea for 108 days recorded 131 total bird-vessel encounters, 17 of which were fatal collisions between eiders (13 king and 4 common eiders) and vessels. Of these 17 collisions, 2 involved mobile offshore drilling units, while the other 15 involved support vessels, which are reasonably similar to the proposed icebreakers. Considering that 10 vessels were involved in 15 fatal eider collisions, we estimate average collision rate per vessel to be 1.5 (i.e., 15 ÷ 10 = 1.5 collisions/vessel) over a 108-day season.

These rates are based on reported collisions for king and common eiders during a single shortened industry season in the Chukchi Sea. Listed eider species were not among the seaduck collisions recorded in 2012, however listed eiders moving through the Bering, Chukchi, and Beaufort seas during the proposed Program would also be at risk of colliding with barges, presumably in proportion to their relative abundance in seaduck populations. Assuming listed eiders are equally as vulnerable to collisions as king and common eiders, and because there is no basis to assume otherwise, we believe information on collision rates of much more abundant king and common eiders can be used to reasonably approximate collision rate for less abundant spectacled and Steller's eiders. To do this, we considered the number of observed collisions for eiders during Shell's 2012 exploratory season in the Chukchi Sea, combined with the estimated number of eiders migrating through the region, which were theoretically exposed to collision risk.

Based on a total of 705,380 eiders (529,271 king and 176,109 common eiders) recorded during migration counts near Utqiaġvik in late summer and fall of 2002 (Quakenbush et al. 2004[22]), we very roughly estimate the risk of collision, per eider passing through the Chukchi Sea, for each vessel operating offshore to be:

> 1.5 collisions per vessel per season ÷ 705,380 eiders = 0.0000021 collisions per vessel per season

We can then roughly estimate the risk of collision for listed eiders migrating through the Bering, Chukchi, and Beaufort seas, by multiplying the individual eider collision rate (described above), by the estimated abundance of spectacled and Steller's eiders from pre-nesting aerial survey data for the North Slope (Stehn et al. 2013)[23]. These surveys estimate spectacled and Steller's eiders number approximately 14,814 (90% CI = 13,501-16,128; Stehn et al. 2013) and 680 (Stehn et al. 2013), respectively. Therefore, we estimate listed eider collision rates would be:

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[22]This survey was based on observed counts from a fixed location. It employed a subset of time intervals and extrapolated the data to account for intervals during which no observations were made. Because the majority of king and common eiders nest in Northern Canada, we believe these counts reasonably estimate the number of king and common eiders passing through Arctic Alaska. Listed eiders were not detected during these migration counts, presumably due to the comparative scarcity and identification challenges for spectacled and Steller's eiders.

[23] These surveys were based on aerial observations of a subset of available nesting habitat on the North Slope. The data were then extrapolated to account for available nesting habitat that was not surveyed.

14,800 spectacled eiders × 0.0000021 collisions per vessel per season = 0.031 spectacled eiders per vessel per season

680 Steller's eiders × 0.0000021 collisions per vessel per season = 0.0014 Steller's eiders per vessel per season

If these figures represent the number of collisions expected per vessel moving through the Chukchi Sea, we can then approximate the number of collisions expected for a total of 270 vessels, over the life of the Program, moving through the marine transit route:

0.031 spectacled eiders per vessel × 270 vessels = 8.37 spectacled eiders

0.0014 Steller's eiders per vessel × 270 vessels = 0.38 Steller's eiders

Because the figures above are based on an approximately 108-day season during Shell's 2012 campaign, we have adjusted the calculations to estimate collisions over approximately 150-days of a typical open-water season as follows:

8.37 spectacled eider collisions ÷ 108 days = 0.078 collisions per day; therefore,
0.078 collisions per day × 150 days = 11.63 spectacled eider collisions

0.38 Steller's eider collisions ÷ 108 days = 0.004 collisions per day; therefore,
0.004 collisions per day × 150 days = 0.53 Steller's eider collisions

Therefore, the Service roughly estimates loss of 12 adult and/or fledged juvenile spectacled eiders, and one adult and/or fledged Steller's eider from collisions with vessels over the life of the Program.